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Vol. 147 SATURDAY, JANUARY 11, 1941 No. 3715

A WORLD PLANNING COMMISSION

THE twenty-five anonymous authors of the Penguin Special "Science in War" (see NATURE, July 27, p. 112) succeeded not only in presenting a review of a few of the many services rendered by scientific men in the present conflict, but also in leaving the impression of vast potential forces insufficiently co-ordinated or inadequately marshalled. Certainly many men of science in Great Britain feel that more direct use might be made of their special knowledge. It may be, as Dr. C. H. Desch has said, that "advisory committees of independent scientific men are appointed by many Government departments, but they rarely have the power to discuss policy, and still less often to make decisions, so that their work is liable to fail of its effect or to be subject to an unnecessary time-lag". On the other hand, there has been a growing realization that part of the blame rests with scientific men themselves, for many have shown lack of appreciation of, even a lack of interest in, the social consequences of their own work, so that it is left to the administrator to formulate plans and make practical applications of scientific discoveries or to set right dislocations of a slowly evolving social structure which a too rapid succession of discoveries inevitably causes.

During the meetings of the Eighth American Scientific Congress held in Washington, D.C., during May 10–18 last, several papers on the conservation of natural resources and allied topics were discussed, and the following resolution was passed :

"WHEREAS : Needless waste and destruction of necessary natural resources everywhere threatens or will threaten, sooner or later, the welfare and security of peoples ;

Throughout human history the exhaustion of these resources and the need for a new supply have been among the greatest causes of war ;

The welfare of every nation requires natural resources which it lacks, and fair access to such resources from other nations is an indispensable condition of national welfare and permanent peace ;

Conservation of natural resources and fair access to needed raw materials are steps toward the common good to which all nations must in principle agree ;

International cooperation to inventory, conserve and wisely utilize natural resources to the mutual advantage of all nations might well remove one of the most dangerous obstacles to all nations to a just and permanent world peace ; and

An Inter-American Conservation Commission representing all the American nations would be of great and lasting value to the Americas, and through them, to all the nations of the world by advancing the knowledge of the natural resources of the earth, by promoting mutual access to necessary natural resources, and by bringing nearer the permanent removal of one of the greatest causes of war,

The Eighth American Scientific Congress

RESOLVES : To recommend to the Governments of the American Republics the appointment of an Inter-American Conservation Commission cooperating with the Pan American Union and representing all the Americas.

That this Commission be charged with the duty of preparing an inventory of world natural resources, and of formulating a general policy and specific program of action to promote the mutual conservation and prudent utilization of natural resources for the welfare of all nations, in the interest of permanent peace."

This resolution is of fundamental interest for several reasons, but particularly because it recognizes the obligation of a single Commission to bridge the gulf between its own findings and their practical application.

Actually this ambitious project is but an extension of the procedure which has been tried

out in the United States. There, after a small and tentative beginning, the National Resources Board was created as part of the Roosevelt 'New Deal' legislation by executive order on June 30, 1934, and charged with the tasks of preparing a detailed inventory and a general plan for the use of the nation's resources. In the following year a Bill was presented in the Senate for the establishment of a permanent National Planning Board. Thus the great work of reconstruction and conservation has been based on the survey initiated by Delano (uncle of the President), Wesley Mitchell and Charles Merriam, with Charles Elliott III as their organizing secretary.

The scope of the prospective world-wide inquiry may be judged from the elaborate and voluminous reports of the National Resources Board. These have been epitomized for the general reader in an unofficial volume by twenty-two authors entitled "Our Natural Resources and their Conservation" (New York: Wiley, 1936). Its ten parts deal respectively with the history of the conservation movement, the conservation of the land and its soil, forests and timber, water supply and power, minerals, wild life, recreational resources, man, the relation of conservation to industry, local, State and national planning.

With the advantages of a common tongue, a unified government control and a uniformly high standard of education, the survey of the resources of the largest free-trade area in the world was in the main a collecting of material already available. The extension of such a survey to all the American republics, and still more to the world as a whole, obviously bristles with difficulties. In the dictator countries, both the knowledge and the planning based thereon are the prerogatives of the *Führer* or *Duce*; in the communist organization, it is the State which nominally formulates and controls its 'five year plans', based on information unavailable outside official circles immediately concerned. Among the democracies, so long as there is free competition and the stimulus of reward to individual effort, much of the essential information is jealously guarded by those individuals or corporations who have worked or paid to possess it. For example, immense sums of money have been spent in exploration work by the great oil companies in all parts of the world: they tend to maintain a close secrecy over the results.

The surmounting of such difficulties is a major task of the Commission: the important point is that the resolution is a practical expression of the ideals of the democratic way of life. These are the ideals for which the British Empire is fighting, and the scientific workers of the Empire should surely associate themselves with the lead thus given by the American Scientific Congress. That the New World has initiated the move should not be a source of jealousy in the Old World torn by strife, but rather a source of inspiration that democracy is a living force with a plan for the future.

MOLECULAR SPECTRA AND MOLECULAR STRUCTURE

Molecular Spectra and Molecular Structure
1: Diatomic Molecules. By Prof. Gerhard Herzberg. Translated with the co-operation of the Author by Prof. J. W. T. Spinks. (Prentice-Hall Physics Series.) Pp. xxviii + 592. (New York: Prentice-Hall, Inc., 1939.) 6·50 dollars.

DURING the last two decades great progress has been made in the experimental study and theoretical interpretation of molecular spectra, which has thus become one of the most important means we have for investigating molecular structure. There is, indeed, no experimental method that gives more detailed information on this subject. From the spectra, the discrete energy states of the molecule, as well as the limits of energy continua, can be derived directly. From these in turn we can draw precise conclusions concerning the orbital motions of the electrons, and the vibrations and rotations of the nuclei. As to the electronic motion, we may learn its quantal type, including its symmetry and arrangement of nodes; we may deduce its energy as a function of the inter-nuclear distances, and its angular momentum; and we can evaluate any associated angular momentum due to an unbalanced relative orientation of electronic spins. This information has led to a deeper theoretical understanding of chemical bindings. As to nuclear vibrations, we can learn their frequencies, calculate the forces between the atoms, and derive also the energy required to bring about dissociation, as well as the dependence of the dipole moment and polarizability of the molecule on inter-nuclear separation. From rotational data we can derive very accurate values for the inter-

nuclear distances, and in special cases obtain information concerning the spin and statistics of the nuclei. The detailed and quantitative knowledge of molecular constitution thus obtained leads, in its turn, to the possibility of calculating certain properties of matter in bulk; for example, in the fields of magneto-chemistry and thermodynamics; the total energy, free energy and specific heats of many gases can be derived more accurately from spectroscopic data than by direct thermal measurement. Other achievements of molecular spectroscopy in the chemical field include the detection and characterization of many molecules, radicals and ions, C_2, He_2, Na_2, OH, CP, H_3^+, HCl^+ and some hundreds of others that were not previously thought capable of free existence, the elucidation of elementary chemical reactions, and the prediction of chemical equilibria.

All this is so much in the spirit of modern physical chemistry, and yet so difficult a field for the novice to enter, that the appearance of a comprehensive text-book in English on the subject by Prof. Herzberg is an event of considerable importance. It will undoubtedly accelerate the future development of physical chemistry; for there could be no better teacher of spectroscopy and its applications than Prof. Herzberg, and no better instrument for the translation of his writings than the collaboration of his colleague Prof. Spinks and himself. In the earlier book "Atomic Spectra and Atomic Structure", which was written and translated in the same manner, we became familiar with that singular clarity of style which makes learning a pastime and renders a comparatively short text both suitable to beginners and sufficiently comprehensive to assist the research worker. The new book, which is an extension of, and improvement upon, the original German text, has all the simplicity and crisp directness of the old; and it goes definitely further in the direction of comprehensiveness. It deals only with diatomic molecules, but the author says in his preface that a further volume on polyatomic molecules "will follow as soon as possible."

In order to assist the beginner, certain sections of the text, which are not necessary for an understanding of the fundamentals, are printed in smaller (but not small) type; while, for the sake of the research worker, an extensive bibliography is given, as well as a number of valuable tables, and diagrams to scale of energy levels and potential curves. One table gives the molecular constants for the ground states of all the diatomic molecules investigated up to July 1939. The research worker will also be glad to find descriptions of procedure, such as the procedure for analysing a band system, or an individual band, locating and identifying energy states, or tracing the potential energy curve for an excited state from intensity variations in continuous absorption. The very detailed subject index, which also contains all terms, symbols and quantum numbers, should be useful both to the beginner and the research worker.

As the author remarks, it is not possible nowadays to give a satisfactory presentation of the subject of molecular spectra and molecular structure without treating thoroughly, apart from the empirical results, the theoretical background also. He has therefore included as much of the theory of molecular spectra as is possible without complicated mathematics. This means, for example, that the general method of deriving selection rules is explained; that all the selection rules which can thus be derived are stated; but that the actual derivation of these rules is carried through only in a few cases, chosen for their mathematical simplicity. On the other hand, a large number of diagrams serve to illustrate and explain the theory, and throughout contact is kept, by the aid of numerous spectrograms, some taken specially for the purpose, with the experimental material that forms the basis of the subject.

The general plan of the book is as follows. A résumé of the elements of atomic structure is succeeded by a description of observed molecular spectra. There follows an account of rotational and vibrational, infra-red and Raman spectra. The main centre portion of the book is devoted to electronic band spectra, leading to the discussion of building-up principles, electron configurations, valency, dissociation, and pre-dissociation. A final chapter describes a number of applications of band spectroscopy to other fields of physics and chemistry, and to astronomy.

The congratulations and thanks of the scientific public are due, not only to the author and translator, but also to the editor of the series, Prof. E. U. Condon, and to the publishers, Messrs. Prentice Hall Inc. In reading the work for the purpose of improving a course of university lectures—more than a casual reading, that is to say—I have noticed very few misprints, none of them serious. The printing is excellent, and the numerous scale diagrams reveal a high standard of draughtsmanship. The paper throughout is so good as to be quite suitable for the spectrograms and diagrams, although many of these are peculiarly rich in detail; thus the necessity for 'plates' is avoided, and the reader secures the advantage that the illustrations appear along with the text to which they relate.

Prof. Herzberg's book will be assured of a grateful reception, and we shall eagerly await the promised sequel on the spectroscopy of polyatomic molecules.

C. K. INGOLD.

SAILING THE SKIES

Flight without Power

the Art of Gliding and Soaring. By Lewin B. Barringer. Pp. ix + 251. (New York and Chicago: Pitman Publishing Corporation; London: Sir Isaac Pitman and Sons, Ltd., 1940.) 17*s*. 6*d*. net.

THE title of this book is "Flight Without Power", but when Chapter vi has been read one comes to realize the tremendous sources of energy that are available to the pilot of soaring craft, and in fact this chapter, which is entitled "Soaring Meteorology", commences with the sentence, "The *power* required for soaring is not derived from any power plant carried by the craft, but has to be taken directly from the energies available in the atmosphere".

"Soaring Meteorology" is contributed by Dr. Karl O. Lange, an authority on the subject, and the chapter is dealt with first in this review, as it is certainly the 'kernel of the nut'. It is well written and is perhaps the most clear, concise and up-to-date exposition on the structure of the atmosphere that has yet been specifically written for the sky-sailing pilot.

When wind is forced to pass over a hill an up-current is provided, and this will support the comparatively lightly loaded glider having a sinking speed no greater, or less than, the upward component of the air, but the pilot is constrained to remain within a relatively small area if he is to retain his height. On the other hand, thermal up-currents are formed in wide distribution over the earth's surface, so that by making use of these the sailplane is free to move in any desired direction, and moreover much greater heights may be attained by this means. As a 'bubble' of hot air detaches itself from contact with the ground, it is caused to rise on account of its decreased density relative to the surrounding air and continues to rise, losing heat on its upward journey due to expansion, until it possesses no excess temperature. But the temperature of the air through which it rises also decreases with height and so tends to accentuate the temperature difference, and so increase the height to which the thermal climbs. This falling off of air temperature with height is known as 'lapse rate' and is of importance to the soaring pilot equal only to that of the wind velocity for the sailing boat. Dr. Lange shows that there are five possible standards of lapse rate, but for successful soaring flight the lapse rate must be unstable, that is to say, the air temperature must fall off by more than 1° C. per 100 metres, the amount by which the air 'bubble' temperature falls off with height. In a lower lapse rate it is obvious that the ascending current would soon lose its momentum and fade. The moisture, or water vapour, carried up in the thermal bubble condenses at a certain height (temperature), depending on the amount of vapour present, since the saturation capacity (dew point) of cold air is less than that of warm air. Thus the well-known cumulus clouds are formed, and they supply the pilot with sure signposts to the presence of ascending air currents. The chapter is well illustrated with cloud pictures and diagrams, and includes much useful information on how best to utilize the clouds and what types to treat with full respect.

The author of this volume is Lewin B. Barringer, one of America's foremost sail-plane pilots and the holder of the coveted 'Silver C'. Apart from considerable flying experience of both soaring and power aircraft, Mr. Barringer for some time managed the Wings Glider School, and therefore writes with knowledge of club organization and instruction. It might be more correct to refer to him as editor instead of author, for although seven of the twelve chapters are written by his pen, 122 of the 223 pages are contributed by others. Chapter i deals with the history of motorless flight and is written by N. H. Randers-Pehrson. "Aerodynamics", written by Paul Schweizer, is interesting and should prove useful, but it is rather slovenly put together and contains several mistakes (mostly careless typographical), and some of the symbols become changed as the chapter proceeds. Paul and Ernest Schweitzer contribute a lengthy chapter on "Design, Construction and Maintenance", but it is chiefly descriptive, and to some extent lacks 'meat'. It does, however, include some interesting details of the "Meise" sail-plane that was chosen as the standard design for the projected 1940 Olympic international competitions.

A brief, but somewhat sketchy, chapter by C. H. Colson is devoted to instruments. Certain basic principles, such as the measurement of air pressure by a Pitot tube, and the action of the gyroscope, are assumed to be known; but if such facts are known by the reader it is likely that a rough idea of the functioning of the various instruments is also known.

The author deals in Chapter iii with types of gliders. Launching methods are fully covered in Chapter v, much useful information being

contained therein. "Towing Methods" are ably described in Chapter x, but the preference for automobile towing for training purposes, in place of winch towing favoured in Great Britain, is a little surprising. Chapter xi, on "Soaring Technique", based largely upon the author's own experiences, is full of interest. "Soaring Sites" and "Clubs" are the titles of the next two chapters, followed by the "Future of Gliding and Soaring", which but lightly touches on the future and is a trifle disappointing.

The book concludes with an appendix giving a list of soaring pilots, contest statistics and table of records, together with biographical sketches of the first ten American 'Silver C' pilots. A bibliography, glossary and index are also included.

In conclusion it can be said that "Flight Without Power" is essentially a book for the potential cross-country sail-plane pilot, and as such it can be recommended as one of the best volumes yet produced.

C. H. LATIMER-NEEDHAM.

THORPE'S "DICTIONARY"

Thorpe's Dictionary of Applied Chemistry
By Sir Jocelyn Field Thorpe and Dr. M. A. Whiteley. Fourth edition (revised and enlarged). Vol. 4: Digallic Acid—Feeding Stuffs. Pp. xxiii + 604. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1940.) 70*s*. net.

SINCE this section of the fourth edition was sent to press one of the editors, Sir Jocelyn Thorpe, has died. It is sincerely to be hoped that the remaining editor will be able to continue the work on her own or will be able to find someone to help her in the tremendous task of revision.

At this juncture it is opportune to direct attention to the format of the title-page. No indication is given therein of Sir Edward Thorpe's editorship of previous editions, nor of their dates, and the younger generation might well be excused for thinking that Sir Jocelyn Thorpe was responsible for them, whereas, in point of fact, there was no relationship between the two men.

The longest article in this section is by the late H. Shankster on explosives, in addition to one on dynamite. No cross-reference is given under nitro-hydrocarbons to "Benzene and its Homologues, Nitro Derivatives", in vol. 1. This omission is perhaps just as well, since the latter contains a drawing of a nitration plant which is certainly not used for explosives. Rumour has it that the plant was designed by a young man without experience in the subject, and the design was afterwards adopted in an emergency plant near London at the beginning of the War of 1914–18, only to result in the plant being blown up owing to faulty planning of the cooling coil which was inadequate to control the heat emitted by the reaction. Whether the rumour be false or only partially true, it does illustrate the fact that the utmost care is needed in the selection of contributors to ensure that the subject-matter is beyond reproach.

Previously, the subject of "Dyeing" and "Identification of Dyestuffs on Fabrics" were separate articles. These are now combined into one under the pen of Ellis Clayton, and "Dyestuffs, Azo", is by M. Lapworth.

Welcome additions, which were not in the previous edition, are well written, and include concise articles on "Industrial Dust", by J. A. Holden and "Dust Explosions", by T. N. Mason. It would have been interesting, however, if the section on the physiological effects had been expanded, especially as regards silicosis. For the safety of workers in the chemical industry, a dictionary such as this one can prove of inestimable help in providing ample and adequate information and reduce those casualties due mainly to lack of knowledge. In fact, any toxic chemical should have a section included on its physiological effects and means of overcoming them.

On the subject of distillation there is an article by J. Reilly and D. F. Kelly on laboratory practice, since the industrial aspect is being dealt with under the heading of "Stills". This article is mainly concerned with the physical chemistry of the subject and does not include the questions of number of theoretical plates and column liquid hold-up: the essentially practical aspect of the subject developed by Podbielniak and others is not mentioned. This is to be regretted, since the practice of laboratory distillation is often little understood by the majority of organic chemists.

"Emulsions and Emulsification" makes its first appearance, and includes line drawings of emulsifiers and a list of recent patents on the chemical side. It is by A. King.

The chemical engineering aspects are covered by "Drying", by S. G. M. Ure, "Evaporation", by J. A. Reavell, and "Extraction", by W. Peck. The article on drying is new, and is a valuable addition. It deals with the various commercial types of plant, which are illustrated in a clear manner, and convey the essentials at a glance. The references are comprehensive, and no doubt explain the absence of drying theory, which is still

in a somewhat transitory state. The photographs in "Evaporation" do not convey much information and could be omitted; little is given on heat transmission and general theory, and no references are included to help the reader to find this information for himself. "Industrial Extraction Apparatus" contains much that is new, especially with reference to sugar beet. Here again, one of the photographs of a thickener could very well be dispensed with.

The general impression left by this volume is that the editors and contributors are to be congratulated on the excellence of their articles, and that if there is, here and there, some scope for criticism, it is almost unavoidable in a work of this nature.

ECONOMICS OF PRIVATE FORESTRY

Economics of Private Forestry
By Prof. Ralph W. Marquis. (American Forestry Series.) Pp. viii +219. (New York and London: McGraw-Hill Book Co., Inc., 1939.) 18s.

THE forestry question is indisputably one of extreme importance in the United States, as the increasing number of books on the subject testify. Some of these have been published in the American Forestry Series of which Walter Mulford is consulting editor. One of the latest is a volume dealing with the economics of private forestry by Dr. Ralph W. Marquis, assistant professor of economics, University of Rochester, New York, which is original in treatment.

As the author states, he is not a professionally trained forester, and his economic views at times run counter to accepted dogmas of the latter. As this book well shows, and is apparently designed to show, the forestry problem in America is to some extent overshadowed by the lumber trade and its interests; a position which probably does not exist to the same degree elsewhere in the world with the exception of Canada. In Britain when we talk about private forestry we allude chiefly to the private landowner, for few public bodies (with a notable exception or two) have interested themselves in the matter.

A perusal of Dr. Marquis's book proves that he is envisaging the matter from the angle of private interests, such as the capital locked up in the lumber companies, the farmer's woodlots, etc. Owing to the serious decrease in the forests and their supplies in the country, due to the gigantic fellings often accompanied or succeeded by devastating fires of the last eight decades or so, serious attention is being given to the future of the lumbering business and the successful marketing of timber from privately owned forests. It may be pointed out that these present only one aspect of this great problem in the United States. The author writes: "Ever since the days when the first Colonists landed on American shores our forests have presented a problem, but the problem has not remained static. As the nation has developed and population has increased, as the forests have been cut down, as homes and factories have been built and farms developed, as all our social and economic relations have changed and become more complex, so has the problem of the proper treatment of our forest resources changed and become more complex."

To the forester this reasoning appears difficult to follow. Many countries in the world have been faced with, or are facing, similar experiences. It is no new problem to the forester; and it is difficult to see why it should prove one to the economist. Demand for forestry produce went up by leaps and bounds in the United States, and the forests provided for the demand and paid the price. What was once regarded as an inexhaustible capital has shown itself to be far otherwise. It is true, as Dr. Marquis says, that many statements have been made on this forest problem and many conflicting solutions offered. In a different degree and from somewhat different angles the same is true for the many types of forests within the confines of the British Empire, not excepting Great Britain. But the answers are broadly the same. What has been utilized or destroyed must be replaced. Capital will be required and perhaps some form of Government legislation, as the author suggests.

In the more undeveloped countries or in those where under the land tenure system in force the State is the greatest landowner, the latter will be the chief forest owner and manager. But in all highly developed States it is recognized that forestry is at its best when State, corporation, town, and even village, with the private landowner in addition, all take a hand in owning and maintaining the area of forest economically necessary for the requirements of that country—so far as these may be provided from the area available for this purpose. These are the broad principles. Dr. Marquis, in directing attention to existing private vested interests, appears inclined to consider that these latter should undertake the chief part in the

forestry problem, the State serving as a benevolent godfather. But Prof. Westveld has shown that the National and States' forests already amount to an area of some 169 million acres, and that the former at least will be considerably increased from the area of approximately 432 million acres still in private ownership. It would appear that there is work for all categories of ownership, the central Government giving the lead.

E. P. STEBBING.

PSYCHOLOGY AND HUMAN VALUES

Nouveau traité de psychologie

Par Prof. Georges Dumas. Tome 6 : Les fonctions systématisés de la vie affective et de la vie active. Pp. 546 + iv. (Paris : Félix Alcan, 1939.) 125 francs.

THE topics dealt with in this volume lend themselves to lengthy and detailed discussion in separate essays, and adequate criticism would necessitate a study of each article in detail. In that case criticism would probably become controversy, since the writers are mostly concerned with highly theoretical issues. Let us say at once that it maintains the high standards of its predecessors alike in the style and quality of its contents and in the excellence of its production. Though the whole work has now grown to dimensions which cause the eyes of busy readers to turn affectionately to its two-volume predecessor, we hope that the remaining volumes will not be too long delayed by the War. Furthermore, it is surely in order to salute our French colleagues and to tender our sympathy and good wishes. The volume under review is a reminder of how much we owe to French psychologists ; probably it could have been produced in no other country. But let one of the volumes be an adequate index to the whole.

The present volume is very reminiscent of the psychological treatises of an earlier day, factual knowledge being less prominent than detailed theoretical discussion and criticism. It is richly informed by recent writings and amply documented ; but more note might have been taken of the work of the pioneers who have tried to break ground in these stubborn fields by experimental methods. A treatise of such scope is incomplete if it does not take full account of the work carried out by Americans in this field, even if the writers think that it only touches the fringe of the subject. English readers may think that less than justice is done to the views of McDougall and Spearman. The present writer believes that the future lies with those who follow the experimental path, even though the results are at present modest. When Prof. Delacroix boldly attacks "Les Sentiments esthétiques et l'Art" and "L'Invention et le Génie" the main result is to show how little can be said authoritatively on the greater values of human life. Nevertheless, a discussion of such problems is profitable when conducted with such clear common sense as the author brings to bear upon them. In fact, the volume is distinguished throughout for hard common sense and insight into the higher levels of man's emotional life. These qualities are shown in the acute criticisms of theories more pretentious than these writers are prepared to offer. While it may be thought that "L'Évolution, la Spiritualisation et la Socialisation des Tendances" are not yet ripe for strict scientific treatment, psychology will profit by the reminder that it has to take them up. The whole volume is a reminder that psychology deals with real and living human beings.

The qualities mentioned are well exemplified in the chapter devoted to volition (Ch. Blondel). The experimental work is fairly discussed and put on one side as unlikely to attain important results by reason of the triviality of the material used ; it is concerned with children's games rather than with true volition. The data secured are only made intelligible by a study of moral choice, thus reversing the intention of the researches. To this it may be replied that the triviality of the material employed in experimental researches does not make the results trivial. The students criticized would be content if they could claim that they had clearly demonstrated this or that feature of volition. Prof. Blondel is too exclusively concerned with moral choice. Not all volitions are on the heroic scale. Even the decision to buy a hat, or to call two spades, deserves analysis, and probably these simpler cases will reveal the central factors present in all volition. But, having entered this protest, we are free to enjoy the broad wisdom and humour of the author's treatment. Like his colleagues, he restores the balance which may be disturbed by deriving wider conclusions from experimental data than they really justify. In this chapter (as throughout the volume) emphasis is laid upon social factors, though much more analysis will be required before the appeal to them can be decisive for psychological theory.

A. W. P. WOLTERS.

SOME RECENT ADVANCES IN DAIRY SCIENCE*

By PROF. H. D. KAY, O.B.E.
NATIONAL INSTITUTE FOR RESEARCH IN DAIRYING, SHINFIELD

COMPOSITIONAL QUALITY OF MILK

ALTHOUGH many mammals other than the cow have been used by man for milk production—in Great Britain we have some 120,000 milking goats at present, and both here and elsewhere sheep, mares, asses, camels, buffalo and deer have been used for producing milk for human consumption—when we speak of milk we usually mean cows' milk.

In war-time, when our diet tends to be restricted directly or indirectly owing to enemy action, the place in the dietary of cows' milk, valuable as a source of vitamins, lime and animal protein, increases relatively in importance. Produced entirely at home and produced to an extent which is less dependent on imported foodstuffs than is usually realized (some 84 per cent of the food of the dairy herd is produced in Great Britain) cows' milk is undoubtedly one of the key food products the supply of which must be maintained by every means in our power. This has been consistently recognized by the Government, which places the dairy cow as '*farm animal, No.* 1', and hopes to be able to meet at least 90 per cent of its pre-war requirements of imported food by restricting the supply to animals of less immediate importance. A tight, well-thought-out rationing scheme is the only way to meet this priority with the minimum of hardship to feeders of other stock.

From the national point of view, and the consumers' point of view, in war-time or in peace-time, but particularly in war-time, there are two separable but related factors in the maintenance of the milk supply—volume and quality. Volume can be measured by the consumer, quality is less readily assessed. Since at present milk is sold entirely on a volume basis, it is not surprising that what concerns the farmer is mainly milk yield—how many gallons he can obtain from a given expenditure of time, labour and feeding-stuffs. But the purchaser of milk, both the milk manufacturer who intends to make cheese or butter from it, or to dry it, and the liquid consumer (though the latter usually does not realize it) are also concerned with milk quality and composition. The food value of the same volume of milk from different cows, or the same cow fed different foodstuffs, is not always the same, though it is true that the usual variation between one *normal* cow and another is not great. Our trouble at present is that too small a proportion of our cows are normal. In practice it is found that between one individual and another, and even between the mixed milk of one herd and that of another, there may be variations of real nutritional importance. Variations in the food value of the same volume of milk as great as 15–20 per cent or even more are not infrequent, though the appearance of the milk and its price to the buyer or the consumer may be the same.

TABLE 1.
LOSS OF GROSS NUTRITIONAL VALUE IN LOW-QUALITY MILK.

	Percentages			
	Fat	Non-fatty solids	Total solids	Water
Typical good herds	4·05 3·75 3·80	9·00 8·95 8·85	13·05 12·70 12·65	86·95 87·30 87·35
Poor herd	3·05	7·85	10·9	89·1
Poor individual cow	2·50	7·45	9·95	90·05
Loss in food value as between good and poor herd ..	about 30%	about 11%	about 24%	—

What are the causes of these variations? Can they be controlled? The organized farmers of the country have shown their anxiety to have these problems solved, and the manufacturers of milk, for obvious reasons, would prefer to have the milk reaching them of more uniformly satisfactory composition. It is a matter of national importance in peace-time, and in war-time of even greater importance to establish these causes, so that we can maintain our milk supply at the highest possible nutritional value.

As a result of extensive investigations during the past few years, the main causes are fairly clearly established, though control of these causes is not so far advanced as could be wished. The following are the main factors concerned, put in probable order of present importance. The relative importance varies from one season of the year to another, and probably from one year to another:

Udder disease, even in the sub-clinical stages.

Feeding of insufficient supplementary food, particularly in late summer, usually associated with drought.

Breed differences.

Physiological disturbances, unassociated with disease in the ordinary sense, probably due to hormone imbalance.

Adventitious watering.

* From a discourse delivered at the Royal Institution on November 19.

There are, of course, minor causes which affect individual cows—for example, end of lactation milk, which is often a little abnormal in composition—but the main causes of low-quality milk are undoubtedly those just mentioned.

Udder Disease. This is at present the principal cause of inferior quality milk. The chief trouble is mastitis—an inflammation of the udder which may vary from very mild to very severe in intensity, and is usually due to infection with a specific streptococcus, *Str. agalactiæ*. It is usually accepted that this particular organism is not pathogenic to the human consumer, even if he drinks the infected milk.

It has been known for a long time that mastitis diminishes milk quantity, and that severe or acute mastitis diminishes milk quality. The main addition to knowledge in the last few years is that udder infection of this type may affect compositional quality quite as seriously, and do so even before the diseased state of the udder becomes patent to the expert eye. In an investigation we carried out some three years ago extending over twenty-nine good commercial herds, mastitis infection was found on bacteriological examination in at least 61 per cent of the animals which yielded low quality milk. Practically all these cases were cases where the disease had not proceeded far enough to be obvious on expert examination of the udder, though a simple examination of the milk would have revealed many of them. It is now known that the test we employed misses quite a number of positive cases, though it does not show any false positives. Hence 61 per cent can be regarded as a minimum estimate; the truth will be nearer 80 per cent.

It has been calculated that mastitis causes a fall in our national milk yield of some 6–7 per cent. I am not too happy about the basis of this calculation, though I believe the result is not far from the truth. If we assume a loss of only 4 per cent in volume, the producers of Great Britain are losing not less than £2,500,000 each year as a result of this loss of milk. There is, in addition, the loss of milk *quality* and food value, so that our figure of £2,500,000 may be taken as a highly conservative estimate of what the nation is paying annually for this disease. We are spending less than £5,000 annually in research on methods of dealing with it.

In war-time this loss of milk and of food value is one we can particularly ill afford. Fortunately the researches of the past few years, parsimoniously supported though they have been, have yielded new information which shows that if a farmer is willing and financially able to take certain simple steps, he can achieve a great measure of control over the severity and spread of the disease in his herd. Though at present he cannot, unfortunately, eliminate it completely, he can, by the regular examination of milk from every quarter of each of his cows, using a simple method which can be carried out on the farm, followed by partial segregation of infected and suspected animals and veterinary help with the treatment of clinical cases, effectively control it, so that yield and quality of milk from his herd will steadily improve and eventually return to the normal. An essential part of the control scheme is the careful disinfection of udders, of milkers' hands, and of parts of milking machines that come in contact with the cow, with dilute hypochlorite solution. Another is the avoidance of rough handling, over-stocking and the misuse of milking machines.

Some of us think that now is the time to apply this knowledge on a national scale. It could scarcely fail to increase appreciably our milk supply, which at present, from a variety of causes, is tending to flag.

Poor Feeding. The feeding of insufficient concentrates has been clearly shown, by controlled examination of data during the last few years, to be another important factor in the production of poor quality milk. Such feeding also obviously affects milk yield. In war-time, with diminished supplies of imported concentrates, this difficulty is not easily overcome; but it must not be assumed that *imported* concentrates are the only foods which will help matters. Home-produced food, with a reasonably good protein content, or even good hay or silage, will help appreciably to maintain both yield and quality in conditions of drought. If more farmers had taken to heart the research findings of the last two decades in improvement of grassland, in the use of the plough on old pastures, in types of grasses to be grown and in methods of management of grassland, the stock-bearing and milk-producing capacity of large areas of Great Britain would have been greatly increased, and our dependence on imported concentrates diminished.

Breed of Cow. It is well known that normal cows of certain breeds such as Friesians and Shorthorns tend to give milk that is somewhat lower both in fat and non-fatty solids than cows of other breeds such as Guernseys or Jerseys, Ayrshires being intermediate.

TABLE 2.

Breed	Fat	Solids-not fat	Protein	Ash	Water
Jersey	5·1	9·6	3·8	0·75	85·3
Guernsey ..	5·0	9·55	3·8	0·75	85·5
Ayrshire ..	3·85	9·05	3·3	0·69	87·1
Shorthorn ..	3·6	8·95	3·3	0·73	87·4
Friesian	3·45	8·5	3·1	0·68	88·0

The average difference is not very great with typical healthy animals of the different breeds; but

it is still quite appreciable, and a gallon of average Jersey milk undoubtedly contains more calories of food value than a gallon of average Friesian milk. On the other hand, the percentage variation in compositional quality of Jersey milk from one milking to another is greater than in the case of Shorthorn or Friesian milk.

Physiological Disturbances. It is now recognized that a number of cows which produce milk of low compositional quality are neither diseased nor insufficiently fed. Their milk may be well below the herd or breed average in composition, and may remain low from one lactation period to another.

In thinking over the various causes which are known to produce changes in the fat content of cows' milk, it occurred to us in 1931 that a rise in fat percentage frequently resulted when the *metabolic rate* of the cow was increased. Why not, therefore, find out whether small doses of thyroxine, the iodine-containing hormone of the thyroid gland which has the characteristic effect of increasing metabolic rate, would increase milk quality when given to a lactating cow?

This experiment was first tried by feeding dried thyroid gland to lactating cows, and preliminary results were obtained showing a rise both in quality and quantity of milk. Eventually it was shown that if thyroxine were administered in small quantities daily to cows past the peak of lactation, both yield and quality of their milk were increased. There was in the milk more protein and lactose and milk fat, and less water. In some cows the daily yield of fat was increased by 40–50 per cent, so the results produced were not small. If, however, the thyroxine were administered before or at the peak of milk production, both milk volume and fat production were diminished.

Concomitant with the increase in milk quality, there was a rise in the speed of circulation of the blood, in the breathing-rate, and in the level of sugar in the arterial blood.

The improvement in milk quality *may* have been due to an increase in the blood sugar. It is known that the level of blood sugar decreases quite markedly whilst the blood is going through the udder, and there is some evidence that the larger the yield of milk, the more blood sugar is taken out of the same volume of the blood by the udder. It is an attractive hypothesis that the sugar-level in the blood reaching the mammary gland is one of the main factors in improving milk secretion. It is known that if the blood sugar is diminished, the amount of milk secreted in a given time is decreased, and also that the chemical quality of the milk produced is lowered.

Whatever the mode of action of thyroxine, there is no doubt of its potency in improving milk quality, and the question arises as to whether poor quality milk that cannot be ascribed to disease or faulty feeding of the cows is due to inherently poor thyroid secretion.

But the thyroid is not the only hormone concerned. It was found some ten years ago that an extract of the anterior portion of the pituitary gland will stimulate milk secretion in animals the mammary glands of which are fully developed but from which the ovaries have been removed. Later it was found that crude extracts of anterior pituitary gland would cause an increase in yield of milk and a slight rise in the percentage of fat in that milk if administered to normal cows in declining lactation. Purified extracts of this gland, containing very small amounts of solid matter, are also potent in this respect. The activity was at first ascribed to a single hormone of the pituitary which was called prolactin. Very recent work has gone to show that this activity is, in fact, due to the co-operation of two separate hormones of the anterior pituitary—prolactin and glycotropin. The whole story, in which the relationship of the pituitary hormones to thyroid gland stimulation is probably involved, is at present far from clear.

The matter is still further complicated by the discovery, made about four years ago, that a hormone of the ovary—œstrone—when administered to a cow in full lactation, causes a slight initial fall in milk yield, but a considerable increase in the proportion of non-fatty solids in the milk, an increase which may persist for weeks after the œstrone treatment has been discontinued and the initial slight fall in yield has worn off.

Though the general picture is only beginning to take shape, we now know of more than one glandular extract by the administration of which milk quality may be, in certain circumstances, improved. Other agents, some of them œstrogenic, as well as being relatively cheap and capable of chemical synthesis, are being tried, dosages and methods of administration compared, difficulties are being overcome, and in time methods of practical importance to the farmer in controlling and increasing udder efficiency will undoubtedly be evolved.

Adventitious Watering. The traditional association of the pump and the milk distributor is one of the three or four classical music-hall jokes. In fact, it is surprising how *little* water is put into milk, when one considers the difficulties of detection and the fact that milk is sold, under our present system, by volume and not by quality.

Methods for detecting added water have improved somewhat during the past few years. The ultimate criterion at present as to whether a given sample of milk is watered is by determination of the freezing-point of the milk. It will be remem-

bered that the dissolving of even a small amount of salts or other small molecular solutes in water depresses the freezing-point below that of pure water to an extent which depends on the number of particles in a given volume of solution. It has been shown that fresh milk shows a practically constant depression of freezing-point (Δ) from one cow to another. If the milk is fresh, whether it is of low or high solids content, or comes from a cow which is healthy or diseased, it almost invariably has a Δ of between 0·530° C. and 0·555° C. Addition of water diminishes the Δ, that is, brings the freezing-point of the milk nearer to that of pure water, in proportion to the amount added, and it may be taken as certain that if the Δ of the mixed milk of a herd, or of a bottle even of pasteurized milk, is below 0·530° C., then water has got into it somehow. All we can then hope is that it is not dirty water.

Little or no variation is caused in this constant even by udder disease. While udder disease may cause a drop in total milk solids, and a rise in the proportion of water present, the diminution in the lactose and other characteristic milk constituents is osmotically balanced by an increase in the amount of sodium chloride, so that Δ remains the same. Pasteurization of the milk, or even boiling, has only a minute effect on Δ. If, however, the milk is kept for a while and bacterial growth sets in, the number of small molecules in the milk begins to increase and the Δ increases also.

(To be continued.)

GEOLOGY AND EARLY MAN

By H. B. S. Cooke, Prof. C. van Riet Lowe and L. H. Wells,
University of the Witwatersrand

THE recent contribution by T. T. Paterson[1] under the above title provides a welcome stimulus towards the general reconsideration of Quaternary events throughout the world, and towards the ultimate unification of our rather scattered knowledge. So wide a survey must inevitably provoke that discussion which Paterson invites in his concluding sentence. His contribution provides an admirable foundation, and should lead, as it has in the case of the present writers, to joint observations by local workers in the various areas and fields concerned. To deal fully with the many points raised would require much space, and as we are most closely concerned with Africa, and particularly with southern Africa, this discussion deals mainly with points relevant to this region.

In such a discussion it is inevitable that most attention is devoted to those topics upon which we differ from Paterson, those upon which we are in agreement with him being largely passed over. It is, in particular, most welcome to find that appreciation is at last given to Geikie's great work, which, though at one time discarded, has now been found to have a sound foundation and a wide application to the northern glaciations. We agree equally with the adoption of Haug's faunal definition of the base of the Pleistocene. Paterson's brief appraisal of the succession of Pleistocene faunal assemblages is also acceptable, and will probably prove to hold good broadly for Africa as well as for other parts of the world.

The geological correlations put forward by Paterson are of a controversial nature, but while the author's studies in India and elsewhere entitle his opinions to the most serious consideration, it would appear in general that the available evidence is inadequate for the conclusions outlined. Correlations within almost every region considered are still very uncertain. The glacial phenomena observed by Lee[2] in China still await detailed work and correlation with the sedimentary cycles; in the same country De Chardin and others are not yet decided upon the course of events; in India, Morris[3] has only recently brought forward evidence illustrative of the difficulties of *cis*-Indus and *trans*-Indus correlation; in northern Africa and in East Africa the sequence is only provisionally outlined, and in southern Africa there is as yet no evidence justifying correlation with other areas.

In the correlation given for the Vaal River Basin, the three phases of the Younger Gravels are indicated as spread over a period ranging from the bottom of the Middle to the lower division of the Upper Pleistocene, while the Older Gravels are placed in the upper portion of the Lower Pleistocene. It must be pointed out that the Older Gravels lie in terraces at elevations from 50 to 300 feet above the present river-level, whereas the Younger Gravels form a closely linked group at levels up to about 40 feet above the river. There is little doubt that the time occupied in the formation of the Older Gravels must have been con-

siderable, and there is also evidence that a long interval separated their deposition from that of the Younger Gravels. The formation of the Younger Gravels cannot have occupied a comparable length of time, and the intervals between the three phases must have been geologically short.

I have recently been attempting to correlate the Quaternary geological events in southern Africa, and though many difficulties lie in the way of effecting correlations even in so small a region, it appears probable from geological and faunal evidence that the Younger Gravels are of Upper Middle Pleistocene age. The Older Gravels are provisionally referred to the Lower Pleistocene, though it is not impossible that they might even range in part into the Pliocene. As a result of this recent work I have also concluded that the grounds for correlation between southern and east Africa rest at present on too insecure a basis to be of much value. This does not, of course, imply that Paterson's correlations may not be largely applicable elsewhere where the evidence is perhaps more adequate, but at present the sequence in the Vaal River Basin cannot reasonably be interpreted in the manner suggested in that correlation.

There is now accumulating a considerable body of evidence to show that world-wide climatic changes occurred during the Pleistocene, and Paterson's observations on the possible cause of the Ice Age are extremely interesting. Daly had already largely established the simultaneity of glacial phenomena in the northern and southern hemispheres, and now Nilsson's[4] work in East Africa and Abyssinia shows almost conclusively that the Pleistocene climatic changes effected a reduction in the width of the equatorial belt and not the southerly shift advocated by Penck and others. Nilsson has also shown the apparent coincidence of glacial advance and "pluvial periods", which provides strong support for the theory that increased precipitation is accompanied by glacial advance. The theory advanced by Paterson would appear to fit in with these conditions and is thus of the greatest interest. Simpson's theory, however, which Paterson regards as the most acceptable, requires the production of two glacials corresponding to one major cycle of precipitation and consequently to only a single "pluvial" episode. On p. 14 of his account, Paterson remarks that the "major periods of aggradation follow on those erosional periods coincident with glacial advance" and this would not be true if a single "pluvial" represented two periods of glaciation. At present, therefore, the precise correspondence between glacials and "pluvials" cannot be regarded as established, and the basis for part of Paterson's correlations is thus very insecure. The effect of the Pleistocene climatic changes is very different in different regions, and the changes in precipitation in southern Africa appear to have been of a sufficiently low order to be readily masked by superimposed local phenomena. There is, nevertheless, a great deal of evidence in the northern hemisphere to encourage the correlation of glacial and periglacial phenomena there, and it should not be long before the extra-glacial regions can be fitted in with some degree of confidence. It is nevertheless felt that the geological correlation must be the foundation of comparison between scattered regions, and that this foundation cannot be established with sufficient confidence in the light of the present evidence.

H. B. S. C.

In his contribution "Studies on the Ice Age in India and Associated Human Cultures" published last year[5], Paterson concluded his chapter on the prehistory of the Potwar and Indus regions with the statement that "further work is being carried out on new finds from the Punjab and the Madras palæolithic industries. Until this work is completed, it would be useless to attempt correlations or comparisons between northern and southern India". Following as this did on an unusually valuable description of the finds from eleven recently discovered palæolithic stations spread over an area of about 10,000 square miles in the basin or vicinity of the Soan River, one emerged from this first comprehensive contribution on the recent geology and prehistory of northern India with great hopes for the future of research in this field.

The outstanding contribution to our archæological knowledge was a detailed description of the Soan Culture originally noted by De Terra[6]. This new culture embodies a progressive series of pebble-and-flake industries spread over a long stratigraphic range. Comparisons could not reasonably be drawn between it (or any phase of it) and pebble, flake, or pebble-and-flake industries in other parts of the world. Yet within a year Paterson has attempted correlations and made comparisons not only between occurrences in northern and southern India but also between occurrences (both geological and archæological) in China, Java, north, central and southern Africa, Germany, France and North America, laying particular stress on the Soan Culture.

This culture is apparently based on eleven sites which yielded (*a*) pebble artefacts in certain cases, (*b*) pebble and Clacton-type flakes in some, and (*c*) pebble and Levallois-type cores and flakes in others—the whole representing five progressive divisions of the main culture. Only one "impure" site was found, namely, Chauntra. This yielded Soan tools together with elements of the hand-axe

culture (? Abbevillian and Acheulean). He goes so far in his new paper as to assign the culture to a "genus" of the Clacton "family" and in it he recognizes half a dozen "species": the Kafuan-Oldowan of East and Central Africa, the pre-Stellenbosch and Stellenbosch I of South Africa, the Anyathian of Burma as well as certain industries discovered by Collins in Malaya, and others by von Koeningswald in Java.

While I wholeheartedly agree that the Lower Palæolithic nomenclature is rapidly approaching a state of complete chaos and that far too many prehistorians and Pleistocene geologists have made excessive and unwarranted use of certain French and Alpine terms, I do feel that in spite of ingenious three-dimensional charts, he has over-emphasized the Soan in relation to other known material cultures. He has built up his argument on far too few facts and has done little, if anything, to ease our present difficulties. The Soan is something new, as the Stellenbosch was new a few decades ago. We know far too little about it. Eleven sites are not enough—more especially when we recall the many thousands of palæolithic home and factory sites that have yielded pebble artefacts of Soan form in Africa alone. It is suggested that the time has not yet arrived when on such slender evidence we can emphasize and interpret this new culture in terms of occurrences at Clacton-on-Sea, on the Kafu in Uganda and along the Vaal in South Africa.

From my own experience in the field and museums of north, central, east and southern Africa, I can definitely say that the descriptions we have of the Soan do not justify our accepting Paterson's views of its importance in the Kafuan, Oldowan, pre-Stellenbosch and Stellenbosch I cultures of Africa. These pebble or core and core-cum-flake cultures certainly include some Early Soan *forms*, but so far as I am aware not one of them includes such significant cores as the distinctly Levallois types that occur in the Early Soan C, for example. We have flake artefacts in Kafuan, Oldowan, pre- and early Stellenbosch assemblages that recall or resemble certain Clacton forms, but none of them yet found is so advanced or sophisticated as the Early Soan specimens illustrated by Paterson. Despite the obvious mastery over the *bloc-en-bloc* anvil technique exhibited by Stone Age man during the Lower Palæolithic in Africa, we are not justified in correlating the cultures that include Clacton-like flakes in Africa with similar occurrences in Europe or India at this stage; or if we are, there would appear to me to be no reason why we should not rather emphasize the more fully described core-cum-flake Stellenbosch of the Cape. For years, for example, I have known the core-cum-flake biface (hand-axe and cleaver) industries of the Madras area to be mirror images of the Upper Stellenbosch of the Cape, which in turn is almost perfectly represented in the Upper African Acheulean of east-central Africa. I have often felt that if at this stage these Madras occurrences are to be given a name other than the helpful but rather loose southern Indian Acheulean, that name should be Indian Stellenbosch, but I have never felt justified in urging my point. Yet the evidence we have for such a comparison is based on much more substantial and widespread discoveries and data (geological and typological) than we have in the case of the comparisons Paterson has drawn.

I cannot escape the conviction that, on the evidence before us, Paterson's interpretations are premature and over-bold. Nevertheless I welcome his contribution, and sincerely trust that the discussions which are bound to follow will bring us a step nearer the solution of the most difficult problem that confronts the prehistorian of the present: the problem of comparison and correlation and the consequent need for a set of terms of wider application than those at present in use. Perhaps I should add that I have for a long time felt that prehistorians cannot hope to solve this major problem until Pleistocene geologists have reached an acceptable agreement on climatic correlations. Once we are able to correlate climatic events in India with climatic events in Africa or Europe or elsewhere, we can compare (1) the remains of human industry recovered from deposits related to these events, and (2) the products of human industry on the bases of typology and underlying processes.

In this way and in this way only, shall we learn whether the Soan of the Punjab is or is not older than the Clacton or Kafuan or pre-Stellenbosch, and so establish the genealogical and generic relationships that may exist between the products of human industry *where we have a sufficiently representative series of products* and allow for missing elements on worked sites. The much-needed new terminology will then emerge naturally. Until this fortunate state of affairs is reached I feel that so far as the Lower Palæolithic cultures are concerned it is better to struggle on (as we perforce must in the Upper Palæolithic) with such *local* terms as Clacton, Kafuan, Oldowan, Soan, etc., and where we can do so on such typological grounds as we have in the great hand-axe cultures, continue the more widespread yet tentative use of such established terms as Abbevillian and Acheulean, prefixing them where necessary with the words "African" or "Indian" as the case may be. In other words, let us for the moment recognize the Soan as something essentially north Indian, and limit the use of the term to India. C. v. R. L.

In the concluding section of his article Paterson treats of "The Development of Pleistocene Man". Herein he advances the conception of a subdivision of human types into three main stocks, Hominoid (Neanthropic), Palæanthropoid (Neanderthaloid) and Pithecanthropoid (including Sinanthropus). Each of these stocks, which it is considered should be given generic status, is supposed to be associated with a particular stream of development of Palæolithic culture. Moreover, as Paterson argues for the formation of mixed cultural groups by the fusion of these fundamental streams, so he presumes a corresponding mixture of the fundamental physical stocks to produce hybrid types.

There is undoubtedly much that is attractive in these views. Unfortunately, in their construction there seems to be insufficient differentiation between established facts and as yet unproved hypotheses. This is glaringly displayed in the opening sentence: "It is *already well established* (italics mine) "that Palæanthropoid man is associated with 'Levallois' culture, and '*Homo sapiens*', as distinct from '*Palæanthropus*' with the Acheul". While the first half of this statement may be substantiated, the second is supported by only the most tenuous evidence. Indeed, the only human fossil which is associated beyond doubt with the "Acheul" hand-axe culture is the Swanscombe skull, and the sapient or even proto-sapient character of this specimen cannot be regarded as proved, in view of the conclusion of the Swanscombe Committee[7]: ". . . it is necessary to admit that the missing parts of the Swanscombe skull may have been so formed as to provide clear evidence of differentiation from modern man." Paterson indeed assigns to his "Hominoid" stock the Piltdown skull, which is neither definitely associated with the great hand-axe culture nor indubitably proto-sapient in character, as well as a number of other specimens of debatable antiquity and associations.

Of these ascriptions the most provoking, to an African anthropologist, is the Kanjera material, the Acheulean associations of which Paterson is prepared to admit in spite of the objections of Boswell. This view may well be correct, although the history of the Olduvai skeleton urges caution. It brings in its train, however, a complication not hinted at by Paterson. Sir Arthur Keith[8] has described the Kanjera remains as "already endowed with features which definitely assign them to the African or Negro stock"; this judgment has been elaborated by Galloway[9], who has demonstrated in detail the affinities between the Kanjera remains and those from Boskop and elsewhere in South Africa. These remains, then, are not "Basic Mediterranean", as implied by Paterson, but in a broad sense "Negroid".

The "Negroid" type Paterson has proposed to derive from a fusion, as early as the middle Pleistocene, of "Hominoid" types practising a hand-axe culture with the "Pithecanthropoid" practitioners of a "Soan" culture. To this hybrid group he assigns Rhodesian man, remarking, at the same time, upon the resemblance of this type to *Homo soloensis*, which is conceived as the continuation of the unmodified Pithecanthropoid stock. Certainly, as has been repeatedly observed, Rhodesian man presents definite affinities to Pithecanthropus and Sinanthropus, as well as to the "Australoid" types of modern man. These indications are elucidated by material which Paterson has not considered, his only other reference to an African fossil type being to "*Africanthropus*" *njarasensis* of Weinert, which is in fact much too fragmentary for serious argument.

Paterson's most notable omission is the Florisbad skull, which is crucial in any interpretation of African types of man. Drennan[10], who in contrast to other South African investigators regards this skull as essentially Palæanthropoid in nature, nevertheless observes that "in Florisbad man, Rhodesian man, and the Cape Flats australoid skull we have a closely related phylogenetic sequence from Southern Africa linking the *Homo primigenius* to the *Homo sapiens* type". Dreyer[11] and Galloway[12], with Sir Arthur Keith[13], have considered the Florisbad skull to be at least proto-sapient and the precursor of later African types. This conception has been developed most elaborately by Galloway, who has shown that the Florisbad type links together the Rhodesian, Wadjak-Australian, and Boskop types. The last-named is clearly intimately related to the Bush-Hottentot group, and probably also to the true Negro, the Asselar skull described by Boule and Vallois forming a possible link between the Boskop type and the Negro. Thus Galloway has envisaged a scheme of relationships for the African and "Australoid" types not far different from that propounded by Paterson. It differs, however, in deriving this type not from a hybrid Hominoid-Pithecanthropoid ancestry, but from a single proto-sapient stock which could equally be the ancestor of the "Basic Mediterranean" and the rest of the sapient types.

Paterson's thesis is in fact an expression of the current tendency to an exaggerated polyphyletic conception of human evolution, though distinguished by his meritorious insistence on the possibility of hybridization as well as of independent evolution. It appears desirable to restate the simpler conception of Sinanthropus (whatever may be the relation of this type to Pithecan-

thropus) as a generalized as well as primitive human type which may well have given rise to both the Palæanthropic and Neanthropic stocks. Whether the differentiation of these stocks took place at the Sinanthropus level or, as is suggested by the Steinheim skull, not until a more advanced stage in development had been reached, is of minor importance. At every stage there must have been a great deal of variation around the periphery of every group. The scheme of relationships proposed by Dart[14] may with advantage be considered in this connexion.

The attempt to combine the discordant interests of polyphyly and hybridization with a formally binomial taxonomy raises in an acute form the problem of the zoological status and nomenclature of human types. Broom[15] has trenchantly criticized the arguments of Zuckerman on this question. Paterson's view, however, formally involves the hybridization of three genera belonging to two sub-families in order to give rise ultimately to a single species. Although the production of fertile offspring is no longer regarded as proof of specific identity, this is not altogether easy to visualize. Whether the problem needs to be solved by the drastic revision of our terminology advocated by Zuckerman remains to be seen. There is undoubtedly much to be said for Paterson's argument that man should be considered as a domesticated animal from this point of view, but the implications of this view demand careful examination.

In concluding this necessarily brief account, I wish to repeat on behalf of my co-workers and myself that our pre-occupation with those aspects of Paterson's comprehensive review which have struck us as particularly debatable does not imply any lack of appreciation of the value of his work as a whole. To have enumerated all the many topics upon which our views agree entirely with his has seemed unnecessary, and we feel that he is especially to be congratulated on his courage in advancing for discussion a thesis which another worker might have pondered but not ventured to publish.

L. H. W.

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By T. T. PATERSON,

UNIVERSITY MUSEUM OF ARCHÆOLOGY AND ETHNOLOGY, CAMBRIDGE

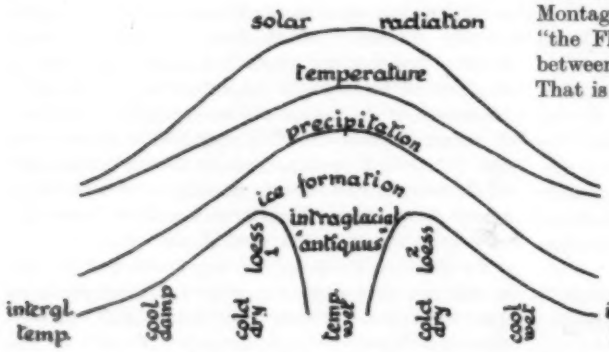
These criticisms are welcome and helpful. In drawing up my Pleistocene correlation I first rejected the idea of glacial-pluvial correlation and began afresh constructing series of sedimentary cycles in tabular form. In areas where the sequence is complete seven cycles are present; in others some are missing, always the earlier. By comparing these tables with the three standards I adopted, those for Europe and India which I know well, and for China (I was assisted in this by Père Teilhard de Chardin), the correlation became obvious.

The Older Gravels of the Vaal River Basin may extend much farther back than phase l_2 but not later. The "long interval" referred to by Cooke, separating them from the Younger Gravels series, is reckoned on erosion depth and so surely depends on the intensity of erosion. A similar "long interval" of this age exists in almost every region. It is one of the stronger supports of my correlation. Moreover, if the faunal evidence suggests that the Younger Gravels are of "Upper Middle Pleistocene age", that is, I presume, on the faunal chronology of Hopwood, then there is nothing in this contrary to my proposition. I am unaware of the existence of a good fauna in the Vaal Basin.

In Simpson's theory the important point is his contention that *increase* in solar radiation produces glaciation; not decrease according to Croll's theory. But my application of Simpson's theory to the correlation which I found to occur, aguing to, not from the thesis of glacial-pluvial correlation, is a modified form of the theory. The curves here illustrate that modification. Thus in glacial and periglacial regions one cycle of solar radiation fluctuation produces two glacial pulsations during each glaciation and two terrace forms, while in non-glacial regions there is only one pluvial period and one terrace escarpment. Therefore, there must have been five major solar radiation cycles, reaching a maximum for the second glaciation and decreasing continuously thereafter.

Prof. van Riet Lowe's criticism deals essentially with nomenclature, though apparently he mistakenly believes that I think the Palæolithic exists in North America. "Further work," including another expedition to India by my colleague H. J. H. Drummond, revealed the Soan wide spread in southern India. There are now more than thirty good sites known to us in the vast area that is India. The Soan technical tradition as I now see it extends from phase m_1 to u_3, from simple pebble tools + flakes, to pebbles + simple cores and flakes (Breckland types), to pebbles + cores

and flakes (Moustierian types). Stellenbosch is a compound name indicating the presence, in South Africa, of two traditions, biface and core-flake-pebble (choppers) conjoined. If one or other of these traditions can be found separately over a long period then each deserves a tradition name, namely, Acheul and Soan. In South India, what I term Soan Acheul, or Acheulian Soan, could quite well be compounded into Stellenbosch and mean the same. If now in the earliest stages of the South African sequence, pre- and Stellenbosch I, only *one* tradition is found then a compound name cannot be applied, but only the single tradition name, and if these stages are core-flake-pebble comparable to the *earliest* stages of the Soan tradition, of the same age, then the latter name is justifiable. The Kafuan-Oldawan is more "pebbly" than the type Soan but within the range of variability of that technical tradition.



CLIMATIC CHANGES IN THE PERIGLACIAL REGION

If, as I believe I have demonstrated, the remains of human industry can be correlated geologically, then the attempt I make at determining the "genealogical and generic relationships" is profitable though it may not by any means be final. The "few facts" to which Prof. van Riet Lowe refers amount to several tons of rock in the Cambridge Museum.

The association, which I "glaringly" state, of proto-sapient and sapient forms with Acheul is based on my own practical experience of the conditions under which four crania have been found. The Swanscombe fragment, phase m_2, is one. Dr. Wells doubts whether I am justified in using this "unproved" evidence of sapient type, but on the other hand a very eminent authority has written castigating me for suggesting that Swanscombe man is anything but *Homo sapiens*. In the case of Piltdown man, depending upon the attitude of each individual researcher, it can be, or cannot be, regarded as proto-sapient; we have but to remember the controversy between Sir Arthur Smith Woodward and Sir Grafton Elliot Smith. For its geological horizon I follow Clement Reid, though I am well aware of Hopwood's opinion, and there is my own knowledge of extensive Lower Acheul occurrences within the gravels of the same age throughout southern England almost to the complete exclusion of others. The Bury St. Edmunds fragment, phase u_2, indubitably sapient, comes from a loam out of which Upper Acheul artifacts have been recovered. There are several sites around the same area where a similar loam yields a complete Upper Acheul industry. The Acheulian association of the Kanjera skull I am well prepared to admit, for I had the good fortune to be with Leakey in East Africa at the time of the controversy regarding this matter.

It is certainly reprehensible that I omitted Galloway's thesis on the relations of the Florisbad skull, but equally reprehensible is it that I did not mention Keith's ideas, Weidenreich's and Ashley-Montague's besides others. Quoting Galloway[1], "the Florisbad type [is] somewhere intermediate between the Rhodesian type and later types". That is to say, Rhodesian man is ancestral to the Negroid. The proto-sapient features of *rhodesiensis* are well enough known and Galloway goes on to say[2], after pointing out the close relationships of the Boskop type, *wadjakensis* and the Australoid, that the "Eyassi and Sinanthropus itself may well be variants of an early generalized type of which Rhodesian Man and Solo Man represent their respective modern recent descendants." The close generic relations of *soloensis* and *wadjakensis* are striking enough, hence these remarks support my proposition. The Florisbad type and *wadjakensis* are but derivatives of the hominoid-pithecanthropoid hybridism, the former towards the Negroid end, and the latter towards the Australoid end of the range of variability. I cannot deny, and make no pretence of doing so, that as a result of heterozygosis, and consequently greater variability within the proto-sapient stock, Kanjera may show Negroid affinities yet remain proto-sapient.

It is obvious that I am driving the hybrid horse rather hard, and this brings up Dr. Wells's last criticism regarding nomenclature. As Holmes[3] says, "few species of organisms present so great a variety of hereditarily diverse strains as our own". Hooton discovered a very fine specimen of a neanderthaloid "all-in wrestler" the other day in Boston, and it seems that the neanderthal type comes within the wide range of variability of the species *Homo sapiens*. I should hesitate

long before suggesting that the pithecanthropoid is also a variety of the same species, but within the next order of difference it can be regarded as a different species of the same genus. That is to say, all those forms I discussed are species and varieties of the genus Homo. I can see, therefore, no objection to postulating hybridism, but like Zuckerman, I believe something must be done about nomenclature. To give an absolute classification, while regarding man as a domesticated animal, is not feasible, for then the wide variation of hominoid forms would demand for its setting out something like the Highland and Agricultural Society's Pedigree Book. I separate out these stocks as "genera", as I have indicated, because there is evidence outside the anatomy to support this first subdivision. Essentially they should be regarded as having at the most no more than specific differences. If I had suggested specific names then the classification of hybrid offspring of these stocks would have been as varieties at least, and the whole system would have become exceedingly clumsy.

I am grateful to Prof. D. A. E. Garrod for pointing out to me that Skhul man is not found with a hybrid culture.

[1] Reference 12, p. 12.
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OBITUARIES

Prof. H. J. Spooner

WE regret to record the death of Prof. Henry John Spooner, former head of the School of Engineering at the Polytechnic, Regent Street, London, on December 16, at the age of eighty-four. Born on June 16, 1856, he received his training at the Royal School of Mines, and was first associated with the Polytechnic in 1882, when the first series of lectures on engineering subjects was given by him. He was appointed head of the School of Engineering on its formation in 1886, a post which he held until his retirement in 1922.

He also practised as a consulting engineer, and took out a number of patents dealing with steam and internal combustion engines. He was one of the pioneer motorists, took a great interest in the early development of the aeroplane, was a great advocate of the elimination of noise, and was also intimately connected with the development of time-motion studies, for the purpose of improving the efficiency of various operations. He was also the author of a number of engineering text-books, and many thousands of students passed through his hands.

During the War of 1914–18, large numbers of workers of both sexes underwent intensive courses of instruction under his supervision, and he was also honorary technical adviser to the King George Hospital and to the Union of South Africa in connexion with vocational training at the military hospital in Richmond Park.

He was a member of the Institution of Mechanical Engineers, an associate member of the Institution of Civil Engineers, a member of the Institution of Automobile Engineers, and a fellow of the Geological Society, in addition to several other engineering and scientific bodies. In 1895 he became a Knight Commander of the Royal Order of St. Sava, Serbia, and in 1907 he became a knight of the Golden Cross of the Redeemer, Greece.

P. KEMP.

Prof. M. Askanazy

PROF. MAX ASKANAZY, a leading Swiss pathologist, whose death has recently been announced (*Schweiz. med. Doct.*, **70**, 1072; 1940), was born at Stallupönen in East Prussia on February 24, 1865. He studied medicine at Königsberg, where he qualified in 1890, and from then until 1895 served as assistant in the Pathological Institute. In 1894 he became lecturer in general pathology, pathological mycology and morbid anatomy, obtaining the title of professor in 1903. Two years later he was appointed professor of general pathology at Geneva. The high esteem in which he was held by his pupils and friends was shown on the occasion of his sixtieth birthday in 1925, when they dedicated to him a *Festschrift* which formed part of the 254th volume of *Virchow's Archiv*. His investigations occupied a wide field, but he devoted himself mainly to a study of the hæmopoietic system, animal parasites, and experimental and spontaneous tumours in man. His chief publications were "Dermoid Cysts of the Ovary" (1905), "Bone-marrow" (1927), and "Inflammation" (1929).

The honours conferred upon him included the Marcel-Benoist Prize in 1936, the freedom of the city of Geneva, and the honorary doctorate of the Universities of Coimbra and Geneva.

He died shortly after his seventy-fifth birthday.

J. D. ROLLESTON.

WE regret to announce the following deaths:

M. Henri Bergson, the celebrated French philosopher, on January 6, aged eighty-two (see also NATURE of January 4, p. 24).

Prof. Raymond Pearl, professor of biology in the School of Hygiene and Public Health, Johns Hopkins University, aged sixty.

Major L. C. D. Ryder, a member of the British Graham Land Expedition, 1935–37, reported killed in action, aged thirty-nine.

NEWS AND VIEWS

Major-General Iven Mackay, C.M.G.

THE mantle of General Monash, the Australian civil engineer who proved to be the greatest military leader of the Australian Imperial Forces during the War of 1914–18, has fallen on another man of science, Major-General Iven Mackay, who is in command of the A.I.F. now operating in Libya which recently took a leading part in the successful attack on Bardia. Mackay was assistant lecturer and demonstrator in physics in the University of Sydney in 1910, where he had obtained his 'blue' for rowing and for football; he combined his aptitude for sport with his scientific training by acting as sports as well as science master in the Sydney Church of England Grammar School during 1905–10. When he joined the staff of the Physics Department of the University of Sydney he also became a sports coach. Later he undertook the duties of student adviser. He worked in the Cavendish Laboratory during 1919. In 1933, he became head master of Cranbrook School, Sydney, and held that position until 1940. During his early career at the University thirty-six years ago he, together with several others, organized the Sydney University Scouts, which eventually formed the nucleus of the New South Wales sector of the A.I.F. Mackay was born on April 7, 1882, the son of a Scottish father and a Canadian mother.

New Year Honours List

THE names of the following scientific men and others associated with scientific work appear in the New Year Honours List: *O.M.:* Prof. Gilbert Murray, F.B.A., trustee of the British Museum and president of the International Committee for Intellectual Co-operation. *Baronets:* Sir Kenneth Lee, lately director general and secretary of the Ministry of Information, formerly chairman of the Industrial Grants Committee of the Department of Scientific and Industrial Research; Mr. Hugh Lett, president of the Royal College of Surgeons. *K.C.B.:* Dr. E. V. Appleton, F.R.S., secretary of the Department of Scientific and Industrial Research. *K.B.E.:* Mr. D. E. Vandepeer, second secretary, Ministry of Agriculture and Fisheries. *Knights Bachelor:* Khan Bahadur Maulvi Azizul Haque, Vice-Chancellor, University of Calcutta; Dr. S. S. Bhatnagar, director of industrial development, Advisory Board of Scientific and Industrial Research, and lately director of the University Chemical Laboratories, Lahore; Prof. W. L. Bragg, F.R.S., Cavendish professor of experimental physics in the University of Cambridge (who is taking the style Sir Lawrence Bragg); Brevet Colonel R. N. Chopra, professor of pharmacology and director of the School of Tropical Medicine, Calcutta; Mr. R. B. Ewbank, lately Commissioner for Natural Resources, Newfoundland; Dr. James Weir French, chairman of Messrs. Barr and Stroud, Ltd.; Mr. P. R. Laird, secretary, partment of Agriculture for Scotland; Brigadier G. Lewis, surveyor-general of India; Prof. J. S. E. Townsend, F.R.S., Wykeham professor of physics in the University of Oxford; Prof. R. S. Wallace, Vice-Chancellor, University of Sydney.

C.B.: Mr. J. S. Pringle, director of electrical engineering, Admiralty; Mr. R. A. Watson Watt, scientific adviser on telecommunications, Ministry of Aircraft Production. *C.M.G.:* Mr. C. Bullock, secretary for native affairs, chief native commissioner and director of native development, S. Rhodesia; Prof. R. T. Leiper, F.R.S., professor of helminthology in the University of London and a director of the Department of Parasitology, London School of Hygiene and Tropical Medicine; Mr. J. R. Mackie, director of agriculture, Nigeria. *C.I.E.:* Prof. H. G. Champion, professor of forestry in the University of Oxford, lately conservator of forests, United Provinces; Mr. C. G. M. Mackarness, conservator of forests, Assam; Lieut.-Colonel H. E. Short, director of the King Institute, Guindy, Madras; Mr. C. C. Wilson, chief conservator of forests (retired), Madras. *C.B.E.:* Mr. G. E. Bailey, managing director of Messrs. Metropolitan-Vickers Electrical Company, Ltd.; Mr. R. T. G. French, secretary of the Electricity Commission; Mr. G. Hogarth, fisheries secretary, Scottish Home Department; Lieut.-Colonel C. A. MacLean, cane commissioner, Bihar; Mr. W. E. Nicholson, director of education, Sierra Leone.

O.B.E.: Sukumar Basu, secretary of the Imperial Council of Agricultural Research; Mr. R. S. Browne, deputy conservator of forests, Madras; Major D. R. Crone, superintendent of the Survey of India; Mr. R. M. Drake, secretary of the Association of British Chemical Manufacturers; Mr. J. R. Haddow, veterinary research officer-in-charge of serology, Izatnagar; Mr. A. G. Herbert, secretary of the Forestry Commission; Mr. C. Hollyoak, superintendent of the Royal Ordnance Factory, Nottingham; Mr. F. G. L. Holland, director of education, Gilbert and Ellice Islands Colony; Dr. H. W. Jack, director of agriculture, Fiji; Dr. J. T. Jenkins, marine superintendent of the Lancashire and Western Sea Fisheries Committee; Mr. H. C. Papworth, principal of the Presidency College, Madras; Mr. G. F. Masters, superintendent of the Royal Gun and Carriage Factory, Royal Ordnance Factories, Woolwich; Mr. J. W. Mills, deputy director of armament production, Ministry of Aircraft Production; Mr. P. A. Mytton, chief livestock officer, Ministry of Agriculture and Fisheries; Mr. J. Taylor, assistant secretary, Ministry of Agriculture, Northern Ireland. *M.B.E.:* Prof. Ananta Prashad Banarji-Sastri, professor of Sanskrit, Patna College, Bihar; Dr. A. J. Noronha, lecturer in bacteriology and pathology, B. J. Medical School, Poona, Bombay; Prof. Cumbakonam Kailasa Krishnaswami Pillai, professor of geology, Presidency College, Madras; Tufail Muhammad Chhaju Khan

Rajput, criminal tribes settlement officer and personal assistant to the collector of Sukkur, Sind; Raj Narain Singh, deputy conservator of forests, Utilization Division, Naini Tal, United Provinces; Dr. Raghunath Sabajirao Tiradkar, professor of medicine, Grant Medical College, and honorary physician, J. J. Hospital, Bombay.

Prof. A. F. Joffe: Award of Order of Lenin

FOR his outstanding work in physics, Prof. A. F. Joffe has been awarded the Order of Lenin, the highest honour in the Soviet Union. The award was made on the occasion of Prof. Joffe's sixtieth birthday. Prof. Joffe's study of the mechanical and electrical properties of crystals has gained him a world-wide reputation. His work on the photo-electric effect and the magnetic field of projectiles is of importance; during the past few years he has investigated semi-conductors. Under the guidance of Prof. Joffe, experiments have been carried out as a result of which it has been possible to increase the frost-resistance of Soviet-grown caoutchouc and to work out a new method for the manufacture of plastic synthetic rubber. He was responsible for the establishment of the Physico-Technical Institute in Leningrad in 1918, the first of a system of physico-technical and physico-chemical institutes in the Soviet Union in Kharkov, Dniepropetrovsk, Sverdlovsk, Tomsk, and elsewhere. Prof. Joffe is a member of the Academy of Sciences of the U.S.S.R. and also of many scientific academies of other countries.

Air Raid Damage at the Royal Observatory, Greenwich

THOUGH parts of the Royal Observatory, Greenwich, have been damaged on several occasions during recent air raids, the historic Wren building of 1675 remains substantially undamaged and the damage to instrumental equipment has been of a minor nature. The south portico of the Altazimuth pavilion was hit by a high explosive bomb and partly demolished. The Altazimuth instrument had recently been dismantled and a small reversible transit instrument mounted in its place; this was thrown from its mounting and broken in two, but the object glass and impersonal micrometer were undamaged. A personal equation machine had been fitted to the collimator in the south portico; this and the collimator objective sustained no damage. Though the main gates were destroyed, the Shepherd 24-hour electric clock, well known to visitors to the Observatory, received only slight damage. The damage to the coverings of the domes has been considerable, but the objectives and mirrors of the principal telescopes, with other valuable equipment, were dismounted and sent away for safety in the early days of the war. The main building, erected at the end of the last century, has received minor damage. The time service provided by the Observatory has been maintained without interruption; alternative arrangements had been made early in the War to ensure its continuance in the event of damage to the Observatory.

Air Raid Damage at the University of Liverpool

THE buildings of the University of Liverpool have been damaged during air raids. One of the chemical departments in the main University buildings received a direct hit, and extensive damage was done in the laboratory, generating and battery rooms; damage to the structure of the building, however, was superficial. Nevertheless, the building was severely rocked and many of the laboratory instruments were affected; the building was not in use at the time and there were no casualties. More than a hundred windows in the University buildings, and particularly the Engineering Laboratories, have been destroyed by blast. Bombs have also fallen in the grounds of both of the University's halls of residence; the damage, however, was slight, consisting mainly of shattered windows.

A Committee on Reconstruction

IT is announced that the Minister without Portfolio, Mr. Arthur Greenwood, has undertaken responsibility for the study of reconstruction and post-war problems. Later on, when the end of the War can be more clearly foreseen, a Ministry will be formed for this purpose. Meanwhile, Mr. Arthur Greenwood will be chairman of a group of Ministers studying these problems. The object will be to find practical solutions for the immediate problems of a transition from war to peace, and also to outline and presently to amplify a policy for the years immediately following the War which will command the support of the nation as a whole and enable united action to proceed in peace as in war.

Medical Planning Commission

A MEDICAL Planning Commission has been set up by the British Medical Association "to study war-time developments and their effects on the country's medical services, both present and future". It will consist of 68 doctors, representing all branches of the profession, under the presidency of Colonel Thomas Fraser, consulting physician to the Aberdeen Royal Infirmary. The detailed work of the Commission will be undertaken in committees and sub-committees. The chairman of the council will be Mr. H. S. Souttar, surgeon to the London Hospital.

The Universities: An American Tribute

YALE and Harvard Universities have sent a telegram to the Universities of Oxford and Cambridge conveying a tribute to the "dynamic courage of Great Britain" and stating that an important aspect of that courage is expressed "in the determination of your scholars to pursue their researches in the spirit of Milton's Seraph, 'Unshaken, unseduced, unterrified' ". The Vice-Chancellors of Oxford and Cambridge have replied, sending "grateful acknowledgments to Harvard and Yale for their tribute to the resolution of this country". They go on to say: "The cause of liberty and learning, now eclipsed over most of Europe, is nowhere better understood

than in the great and historic institutions from which these Christmas greetings come. The more profoundly do we appreciate their noble and moving recognition of our endeavour, together with the other Universities of Great Britain, to maintain the continuity of scholarship and to keep, even in these days, the standards of knowledge unimpaired and the sources of truth unsoiled."

University of London Certificate in Natural History

JUST before the outbreak of war, the University of London, in response to an expressed demand, instituted a Certificate of Proficiency in Natural History, designed for teachers who require an additional qualification testifying that they have a practical working knowledge of natural history such as will be of special value in teaching it to children up to the age of fifteen. The necessary studies involved attendance at a course of lectures and laboratory work of about three hundred hours' duration, together with a certain amount of organized field-work. Considerable interest was shown in the University's new departure, and some education authorities were prepared to arrange suitable courses: but the dislocation of the school teaching services all over the country has brought about the result that the courses of study contemplated by the University are not suited to the present-day circumstances of teachers.

Consideration has therefore been given to the possibility of devising some special emergency regulations which would meet the intention of the original requirements and make the best use of the fact that large numbers of urban schools are now located in the country or at the seaside, and so presented with an opportunity of natural history study in the field which, under normal peace-time conditions, would have been impossible; as a result emergency regulations have been drafted. The main principles of the proposed new regulations are: (*a*) to substitute for the present lecture-laboratory requirement a directed course of private reading together with attendance at a fortnight's summer vacation course arranged by the University, and (*b*) to take advantage of the teacher's probable extended period of residence in rural conditions by putting the main emphasis on the work in the field, involving the writing under expert advice of a substantial essay on some specialized topic chosen by the student. At the moment, however, the University has no evidence as to how far such a scheme would be welcomed by those teachers who might have been expected under normal conditions to have studied for the original Certificate. Any teacher, therefore, who is interested in the proposed new scheme as outlined is invited to communicate with the University Extension Registrar, University of London, at Royal Holloway College, Englefield Green, Surrey.

A War-Time Formulary

IN view of the urgent need for a comprehensive war-time formulary for the guidance of medical prescribers, it is satisfactory to learn that, at the instigation of the Ministry of Health, a strong and representative committee has been set up for the purpose of providing such a formulary for use during the emergency. The following bodies have been invited to appoint representatives: the Royal College of Physicians, the Pharmacopœia Commission, the British Medical Association, the Pharmaceutical Society, the National Pharmacists Union and the Wholesale Drug Trade Association. It is understood that the Committee intends to complete its work as speedily as possible. The publication of this formulary will be welcomed by medical men and dispensers, who are at present without an official guide as to the best substitutes for drugs which are now almost unobtainable and the best methods of compounding them for administration to patients. Apart from the few additions to the monographs of the British Pharmacopœia and alterations of a few monographs and lists of scarce drugs and suggested substitutes prepared by the Medical Research Council, no attempt has hitherto been made to compile a comprehensive book of formulæ for use during the period of emergency.

New Winter Forage Grasses

WINTER forage in Great Britain is a matter of first importance to the farmer and any new methods of ensuring a supply are worthy of careful consideration. W. Davis has brought forward the suggestion (*Emp. J. Agric.*, **8**, 289; 1940) that pampas and tussac grasses, although exotic species, might profitably be grown for this purpose. Pampas grass (*Cortaderia selloana*) is a common ornamental plant in Britain, and though its leaves are coarse and harsh, it appears to be surprisingly palatable. It is both winter green and able to withstand drought, so that it would be productive just when other pasturage is short, and further, its tussock-forming habit would be specially valuable on hill pastures during periods of snow. The use of pampas grass has recently been investigated in New Zealand, where the results are promising.

Establishment from seed is slow, and it is probably best raised under nursery conditions and not grazed for at least a year. Chemical analyses show that it is considerably less nutritive than clover or young grass, but its relatively high yield (50 tons per acre per annum) and the fact that it is consumed *in situ*, thus avoiding labour costs, are compensating features. Tussac grass (*Poa flabellata*) is a much-prized forage plant in the Falkland Islands. Like pampas grass it is slow to establish, but once the initial stand is secured, the crop should go on indefinitely. In its natural habitat (the sea coast), this grass shelters numerous birds and seals, whose trampling and scratching cultivates the soil, while their excreta act as manure; inland the domestic fowl serves the same purpose. This combination of plant and animal life appears to be of fundamental importance to the healthy maintenance of the tussac plant. There seems no reason why these two grasses should not flourish in Great Britain, and both would probably merit a trial, as they would prove a valuable asset when the usual types of winter feed are scarce.

The Commonwealth Solar Observatory, Canberra

THE first report of the present Director of the Mt. Stromlo Observatory refers to the period May 1939–April 1940, though it also sketches the history of the Observatory since its establishment in 1910, and gives a brief account of the main observational programmes carried out since the first Director's appointment in 1924. The observations of solar radiation begun in 1926 have been completed, and a discussion of the results is promised. One of the most interesting conclusions is that the correlation between total solar radiation and duration of bright sunshine is so close as to be useful for derivation of the first quantity, the direct observation of which is difficult, from the second, which is a standard meteorological datum. Spectroheliоscopic and visual observations of the sun have been directed respectively to the detection and mapping of bright solar eruptions, several spectrograms of which have been obtained during 1939. As compared with flash spectra, these show a puzzling enhancement of low-excitation Fe I and Fe II lines.

A new programme of stellar observations is planned for the Reynolds 30-inch reflector which has been converted from Newtonian to Cassegrain form for the purpose. A single-prism spectrograph for spectroscopic parallaxes and a photo-electric photometer have been made for use at the Cassegrain focus. The work on cosmic radiation and atmospheric physics with which the name of the Observatory is especially associated has been carried on with a few modifications, chief among which are the discontinuance of the observations of atmospheric electricity and night-sky luminosity, and an extension of the work on cosmic rays and the ozone content of the atmosphere. With the establishment five miles away of an official Commonwealth meteorological station, many of the routine meteorological observations have been discontinued, though measurements having a direct bearing on other Observatory programmes are still being carried out. An impressive list of papers published during the year shows that the establishment is more than maintaining its high standing amongst southern hemisphere observatories.

New Russian Botanical Gardens

NEW botanical gardens, attached to the Armenian Branch of the Academy of Sciences of the U.S.S.R., were recently opened in Erivan, capital of the Soviet republic of Armenia. The gardens, which have some three thousand species of plants, have grown up during the course of five years on the dry, stony, desert soil between the settlements of Avan and Kanaker, near Erivan, which has been reclaimed. One of the most interesting departments of the gardens is the section devoted to the plants of Armenia. Ultimately, some 2,600 specimens of the flora of this republic will be collected there; the section already has 350 specimens. In the centre of this section has been built a pond, resembling the high mountain lake of Sevan. In the pond have been planted specimens of water plants of Armenia. In the southern part of the gardens the Geographical Department is concentrated. More than half the area of the gardens is occupied by arboreal plants. The flower gardens are exceptionally rich; in the Avenue of Roses and Fountains more than a hundred varieties of roses have been planted.

Health in Sierra Leone

IN the latest annual report of the medical services of Sierra Leone, the director, Dr. W. P. H. Lightbody records a satisfactory state of general health among a population of about 100,000 and an absence of major epidemics. Nutrition in the undisturbed tribal communities is fairly satisfactory, but in Freetown, the capital, with a population of 55,000, and the adjacent villages there is some evidence of qualitative defects in diet, mainly an insufficiency of protein. Among the 250 European officials resident, the average annual sick leave per resident was 6·46 days, almost exactly the same as that of the 1,000 African officials. Only 3 European officials were invalided home during the year. Among the 495 European non-official residents the total number who went on sick leave was 73. The most frequent causes of death among the population in Freetown was malaria, which causes nearly twice as many deaths as tuberculosis, the second largest cause of mortality. Malaria also accounts for 43 per cent of the hospital cases in the colony.

The Wellcome Foundation Ltd.: Appointments

DR. R. A. O'BRIEN, who joined the staff of the Wellcome Physiological Research Laboratories at Beckenham in 1910 and became director in 1914, retired at the end of 1940. Dr. J. W. Trevan, who became head of the Pharmacological Section in 1920, has been appointed to succeed him. Dr. S. Smith, head of the Experimental Research Department and manager of the Wellcome Chemical Works at Dartford, has been appointed director of the Wellcome Chemical Research Laboratories at Beckenham. Dr. W. M. Duffin has also been transferred from Dartford to Beckenham. Mr. J. Russell has been appointed manager of the Wellcome Chemical Works. Mr. R. L. Grant has been appointed head of the Chemical Manufacturing Department on the retirement of Mr. W. Taylor.

Announcements

MR. AXEL L. WENNER-GREN, a Swedish industrialist, has given a cheque for ten thousand dollars to the University of Toronto for the extension of the work of its Geophysics Department.

THE following vital statistics for Scotland for the quarter ending June 30, 1940, have been published by the Registrar-General: The birth-rate was 18·6, the lowest ever recorded for the second quarter of any year since the institution of national registration in Scotland; the death rate was 12·8, and the infantile mortality 67, which is 1 below the average for second quarters of the year.

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. They cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

IN THE PRESENT CIRCUMSTANCES, PROOFS OF "LETTERS" WILL NOT BE SUBMITTED TO CORRESPONDENTS OUTSIDE GREAT BRITAIN.

Penetrating Cosmic Ray Showers

IN a recent communication[1] we gave some evidence for the existence of penetrating showers. We have now extended these observations to the transition curves of the showers in lead and in aluminium with the same experimental arrangement. Five-fold coincidences 1, 2, 3, A, B, and the number (n) of the counters H discharged simultaneously were recorded. Due to a slight change in the counter arrangement, our present rates are about 30 per cent higher than those reported previously. The results are summarized in Table 1 and the accompanying graph.

As before, it will be assumed that only the records with n greater than or equal to 2 represent genuine penetrating showers.

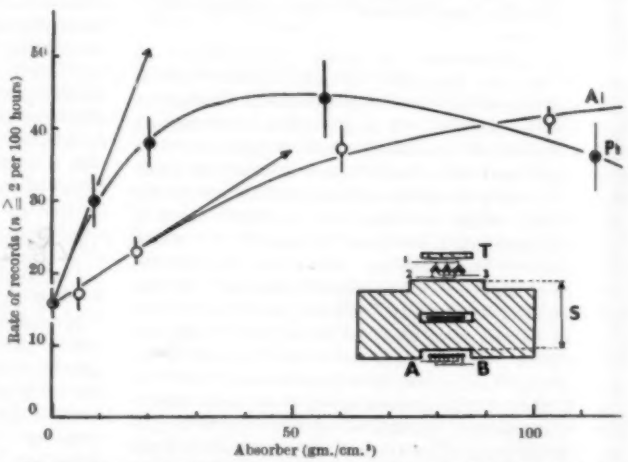
The initial slopes of the transition curves are significant for the cross-sections for shower production. It appears that the observed ratio of the slopes of the lead and aluminium curves is the same, within the experimental error, as the ratio of the corresponding cross-sections for the production of electron pairs by high-energy photons. The arrows drawn in the graph represent slopes having this ratio. The comparison of the lead and aluminium transition curves suggests therefore two possibilities. The first is that these showers are cascade showers. As pointed out before[1], this assumption implies the breakdown of the cascade theory for high-energy photons and electrons. The second is that the showers are due to meson pair production or a related process.

Experimental evidence for the occurrence of meson pairs has been obtained from cloud-chamber photographs by Herzog[2] and Powell[3]. Meson pairs seem, however, to occur rather infrequently, and it is doubtful whether or not they can account for the observed rate of penetrating showers.

The theoretical cross-section for meson pair production by a photon of energy $h\nu$ is, according to Booth and Wilson[4],

$$\overline{\Phi}_{\text{meson pair}} = \frac{5}{9}\frac{e^2}{\hbar c}\left(\frac{e^2}{\mu c^2}\right)^2 \frac{h\nu}{\mu c^2},$$

where μ is rest mass of meson. From this we calculate the slope of the lead transition curve to be 0·0015 cm.$^{-1}$ hour^{-1}, while the observed slope is found to be 0·2 cm.$^{-1}$ hour^{-1}. Thus the observed effect is much larger than that predicted on the assumption of meson pairs.



TRANSITION EFFECT OF PENETRATING COSMIC RAY SHOWERS IN LEAD AND ALUMINIUM. INSET, THE EXPERIMENTAL ARRANGEMENT

Another difficulty arises from the fact that, as the records show, most of the showers contain many more than two particles (see Table 2).

TABLE 1.

T (cm. gm./cm.²)	Material	Rates per 100 hour	
		$n = 0-8$	$n \geq 2$
0	Light roof only	56 + 4	16 ± 2
0·8	8·5 Lead	89 ± 6	30 ± 3·5
1·8	20·0	127 ± 6	38 ± 3·5
5·0	56·5	99 ± 8	44 ± 5·5
10·0	113·0	104 ± 9	36 ± 5
2·0	5·4 Aluminium	73 ± 5·5	17 ± 2·5
6·5	17·5	91 ± 5	23 ± 2
22·0	60	115 ± 6	37 ± 3·5
38·0	103	136 ± 5·5	41 ± 3

TABLE 2.

Number of rays	0	1	2	3	4	5	6	7	8	Total
Observed frequency	854	911	184	139	130	108	80	85	49	2540

Thus in order to maintain the assumption of meson creation by photons, one has to assume that the process in question is a multiple one, that is, one photon giving rise to several mesons simultaneously; alternatively, one can assume that the photons arrive frequently in large groups creating several independent meson pairs simultaneously.

Whatever is the actual process for the production of these penetrating showers, it is probable that they are produced by the soft component of cosmic rays.

because (*a*) saturation is reached at about $T = 5$ cm. lead, and (*b*) the cross-section of their production varies as Z^3. If the penetrating showers do consist of mesons, then the result that the cross-section for their formation varies as Z^3 is consistent with some other evidence. An estimation of the rate of mesons produced in the atmosphere by the process responsible for the penetrating showers gives a reasonable rate of meson production on the assumption that the cross-section varies as Z^3; but on the assumption that the cross-section varies as Z the rate obtained is too high.

L. JÁNOSSY.

Physical Laboratories,
University,
Manchester.

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Pseudo-dominance in Polygenic Characters

F. W. Dry, P. R. McMahon and J. A. Sutherland in a recent communication[1] describe the inheritance of so-called halo-hairs (*N*-type) in lambs, which they found to have a multifactorial basis. *N*-type is, according to the authors, conditioned by a single factor dominant over the not-*N*-type (linked with the sex-influenced factor for horns, with crossing-over occurring about once in ten or twelve times).

But the authors found themselves a "little surprised" by one aspect of the situation, namely, that sometimes not-*N*-types (from *N*-type stock) produce *N*-type offspring. The authors suggest two explanations: two linked complementary factors for *N*-type, or dominigene hypothesis.

The observed facts require, I think, another interpretation. The reciprocal appearance of *N*-type in alternative generations is due to its polygenic basis, in which case an assumption of dominance, of dominance modifiers (dominigene) or of linkage is superfluous. The change in the usual dominance of *N*-type, or rather the appearance and disappearance of halo-hairs in succeeding generations, is a result of different assortment of modifiers, some of which (*I*) increase the number of halo-hairs, other of which (*D*) diminish it and cancel their appearance. If, for example, a lamb should inherit two modifiers *I*, each of which produces 100 halo-hairs per unit area, and four modifiers *D*, of which every one decreases the number of halo-hairs by 100, then this lamb would be not-*N*. These not-*N* animals mated together may produce lambs with halo-hairs (*N*-type) if they inherit more *I* genes than *D* genes. In the breeding experiment cited by Dry *et al.*, a not-*N* ram, son of an *N*-type son of the original *N* ram, was mated with not-*N* ewes (with no or few halo-hairs on the back), daughters of the original ram or of one or other of his *N*-type sons. The results were: 2 typical *N*-type and 9 not-*N* with halo-hairs absent or of low abundance on the back. These pseudo-dominant *N*-types appeared here from pseudo-recessive not-*N* parents, because these parents were polygenic and heterozygous for halo-hairs. The number of factors in the halo-hair character is probably a large one, and therefore the homozygous *N*-type, or homozygous not-*N* practically never occur. Consequently different recombinations are possible, producing the same visible type, *N*, and these pseudo-dominant *N*-types mated together give not-*N*; conversely the pseudo-recessive not-*N* (being polygenic and heterozygous) may produce *N*-type.

We cannot expect a constant ratio in F_2, but various ratios (sometimes accidentally a ratio 3 : 1), because the genotype of halo-hairs consists of many modifiers, and almost every polygenic *N*-type, or not-*N* depends upon a different assortment of genes.

For the same reason we can scarcely expect a ratio 1 : 1 in 'back-crosses', except by accident. This assumption is supported by results from 'back-crosses' which the authors obtained.

They say: "in back-crosses of heterozygous *N*-type (so regarded from their parentage) to not-*N*, some ratios are almost exactly 1 : 1, but in the offspring of some tested rams there is a deficiency of *N*-type, that is, an excess of lambs definitely not-*N*. Whether this deficiency of *N*-type is significant, and how it is to be interpreted if it is real, are matters calling for further experiment".

This "deficiency" is, we think, due to the fact that not only was the *N*-type heterozygous in these pseudo-back-crosses, but also the not-*N* was probably also a polygenic, heterozygous type, instead of a homozygous recessive. It was not a back-cross at all, but a mating of two heterozygous, polygenic types, which has given therefore different assortments of modifiers, and not a simple 1 : 1 ratio. This "deficiency" can be accounted for by the great excess of *D* modifiers in not-*N*.

The "dominance" of *N*-type seems to be an illusory one, and is not dependent on the dominance of the special gene for *N*-type. The *N*-type ram crossed with not-*N* ewes will sire *N*-type offspring, not because his halo-hair factor is dominant to not-*N*, but because the genotype of this ram includes a great number of modifiers *I*. For example, a (20 *I*, 2 *D*) ram mated to ewes of not-*N* (10 *I*, 12 *D*), having only a small excess of *D* modifiers, will give mostly *N*-type. Here we have a case of pseudo-dominance due to parents, with heterozygous polygenic character, transferring a great number of *I* modifiers to the following 'F_1' generation.

The appearance of not-*N* out of *N*-types by not-*N* is dependent on the presence of *D* modifiers in the *N*-type. These views are supported by the following statement made by Dry: "This *N* factor (or possibly *N* complex) sometimes comes to incomplete expression, so that the lambs fall a little short of the abundance of halo-hairs regarded as properly gross".

From the above we can see that the results obtained in F_1, or from 'back-crosses', are not always proof for dominance, that is, in cases where the character analysed is a quantitative one.

There are known in animals some other cases in which both parents of type *A* produce offspring of type *B*, and parents of type *B* produce *A* offspring. The inheritance of these cases (if polygenic) could be interpreted similarly as *reciprocal type of inheritance*. In polygenic characters we deal almost always with heterozygous material and consequently we can scarcely expect simple Mendelian ratios in F_2 or in back-crosses. The appearance or disappearance of a character in succeeding generations will depend on the numerical proportion of quantitative factors or modifiers. The excess of some will cause a given character to show (type *A*), and on the contrary the excess of the others will produce the opposite type *B*.

This reciprocal appearance of type *A* or type *B* will continue without special ratios in successive generations. It can be influenced by natural or artificial selection. After many generations of selection in one direction, there is produced an assortment of modifiers of the same type, and the observed character becomes pseudo-dominant.

T. M. OLBRYCHT.

The Galton Laboratory,
Rothamsted Experimental Station,
Harpenden, Herts.
Dec. 7.

[1] NATURE, **145**, 390 (1940).

Immunity from Cellular Changes in the Blood

CUMULATIVE evidence from a series of investigations on *Past. pestis*[1,2,3], specially in relation to active, passive and natural immunity and bactericidal tests *in vitro* and *in vivo*, strongly suggested that the humoral factors could only be partly responsible for host resistance against a highly invasive organism like the plague bacillus.

During the course of studies on the cellular reactivity to plague infection it was observed that certain types of changes took place in the white cells of blood which, when studied by the supravital technique as described by Sabin and her collaborators[4,5,6], were found to be indicative of (*a*) active immunity, (*b*) passive immunity, and (*c*) susceptibility on the part of the experimental animal.

Bombay rats were employed for the study of active immunity since they are partially immune to plague infection, and a certain percentage of them always survived the test infective dose. Haffkine Institute inbred white mice, which have been shown to be most susceptible to plague[7], were used as controls as well as for passive protection tests. It was possible to study the cellular changes for a number of days in the same animal by bleeding it from the tail every morning and afternoon.

Both active and passive immunity were associated with the presence in the blood stream of those cells which have been variously described as clasmatocytes[8], histiocytes[9], and as wandering endothelial phagocytes[5].

(1) In active immunity there was a constant 'shower' of clasmatocytes which, along with an increase in the total number of leucocytes and abnormal functional activity on their part, indicated that the animal was going to survive. On the other hand, where, in a partially immune animal, the plague infection was going to prove fatal, the percentage of clasmatocytes was low and they were present for the first 48–72 hours only; the functional activity of both the monocytes and the granulocytes was below normal and the neutrophils gradually lost their motility and became rounded. Towards the end, the white blood cells presented a typical moth-eaten 'ground glass' appearance without vacuoles or granules. This picture always connoted a very grave prognosis and invariably ended fatally.

(2) In a susceptible animal, like the white mouse, no clasmatocytes were seen at any stage of infection. From the cellular point of view the animal took a downhill course almost from the very start. All the signs associated with grave prognosis developed by about the fourth day, and in spite of a total white cell count of 40–50,000 per c.mm., and a monocytic percentage as high as 25, the animal succumbed to infection on the fifth to seventh day.

(3) In passive immunity the presence of clasmatocytes was directly related to the envelope antibody—the protective component of an anti-plague serum[10]. There was, however, a threshold value below which the clasmatocytic cellular reaction was not observed. Above the threshold value the percentage of clasmatocytes and the duration of their presence in the blood stream depended on the amount of the envelope antibody administered.

The somatic component of an anti-plague serum, which in animal experiments was devoid of any protective value[3], was never found to be associated with the appearance of clasmatocytes in the blood stream.

The details of this investigation are being communicated elsewhere.

S. S. BHATNAGAR.
D. L. SHRIVASTAVA.

Haffkine Institute,
Bombay.
Nov. 7.

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Pigments of *Iris pseudacorus*

A NUMBER of blue and purple varieties of the Iris family have been included in their "Survey of Anthocyanins" by G. M. and R. Robinson, who have specified the particular anthocyanidin present in each case. They have found, for example, that *Iris miranda*[1] contains a complex delphinidin diglycoside and that a malvidin 3 : 5 dimonoside mixed with what is probably a petunidin derivative is present in *Iris Kæmpferii*[2].

On the other hand, *Iris pseudacorus*, commonly known as the water-flag, owes its colour to the presence of carotinoids, a fact which was first established by van Wisselingh[3] from a cursory examination of the flowers by means of colour reactions.

We are at present engaged on a detailed investigation of the nature of the carotinoids present in *Iris pseudacorus*. We have succeeded in resolving the very complex mixture of pigments present into five different fractions. β-Carotene is present, and from the mixture of other pigments, which are xanthophylls, violaxanthin and lutein have been isolated and characterized. Whilst these constitute the major portion of the xanthophyll fraction, spectroscopic evidence disclosed the presence in very small amounts of what is probably zeaxanthin. In addition, a dark red wax-like substance, with absorption bands in carbon disulphide at 496, 465 and 436 μμ, was isolated. Kuhn and Winterstein[4] in their examination of the carotinoids of *Viola tricolor* obtained an unidentified coloured waxy product which had the same

absorption maxima. The above xanthophylls are present in the petals in the ester form.

We hope to publish shortly a detailed account of this investigation elsewhere.

W. F. O'CONNOR.
P. J. DRUMM.

Chemistry Department,
University College,
Cork.
Dec. 18.

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Influence of Purines, Creatinine and Creatine on the Oxidation of Vitamin C

IN a recent communication[1] evidence was presented to show the co-existence of oxidizing and protective mechanisms for vitamin C in plant tissues. While investigating the effect of various biologically important substances of very diverse nature, on the oxidation of vitamin C in presence and absence of Cu^{++}, we have made some observations regarding the influence of purine derivatives, creatinine and creatine on the oxidation, which offers useful information regarding the nature of the protective mechanism existing in plant and animal tissues.

The oxidation of vitamin C was studied at *p*H 7·2 in presence of Cu^{++} in the Warburg manometers at 30°. The oxygen uptake was measured in the presence and absence of the substances under investigation, and the results are presented in the following table.

Ascorbic acid, 2 mgm.; Cu^{++}, 0.71 μgm.; total volume 3 c.c. Air, 30°.

	Substance	Concentration *M*	μO_2 uptake	
			Time in minutes	
			15	30
Vitamin C + Cu^{++} +	None	—	66	130
" " +	xanthine	0·00017	0	0
" " +	uric acid	0·00015	0	0
" " +	theophylline	0·00014	13	17
" " +	theobromine	0·0007	65	120
" " +	caffeine	0·00064	62	121
" " +	creatinine	0·0011	5	10
" " +	creatine	0·00095	62	130

The results show that the oxidation of vitamin C by Cu^{++} is completely inhibited by the purines—xanthine, uric acid and theophylline, in a final concentration of 0·00014–0·00017 *M*., while caffeine and theobromine even at higher concentrations have no influence on the oxidation. The imino group appears to exert influence on the inhibiting action of the purines, as only those of which the imino group is free (for example, xanthine, uric acid and theophylline) inhibit the oxidation, while those whose imino groups are methylated show no inhibitory effect (for example, caffeine). Further, the presence of methyl group in position 7 completely prevents the inhibiting action of the purines, although the other imino group is free (for example, theobromine). Thus the imino group in position 7 of the purine derivatives appears to exert a decisive influence on the oxidation of the vitamin.

An interesting difference between creatinine and creatine, the two important constituents of the muscle, is revealed by their influence on vitamin C oxidation. Although creatine has no influence, creatinine exerts powerful protection against the oxidation of the vitamin. Similar results were obtained when the oxidation of the vitamin was followed by titration with the indophenol dye.

In addition to glutathione and other thiol compounds which are known to exert similar protective action against the oxidation of vitamin C, the presence of purines and creatinine in the body may insure the existence of reduced vitamin C or prevent the oxidation of the vitamin by Cu^{++}.

Further work on the mechanism of inhibition of the oxidation by the purine derivatives is in progress. Full details of the work will be published elsewhere.

K. V. GIRI.

Andhra University,
Waltair,
South India.

P. V. KRISHNAMURTHY.

Andhra Medical College,
Vizagapatam,
India.
Nov. 1.

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Hydration of Carbon Dioxide and the Stability of Hypochlorite Aerosols

Powell[1] and Baker and Finn[2] have considered the effect of the slow hydrolysis of carbon dioxide on the stability of hypochlorite aerosols. The work of McBain[3] is quoted when in fact much subsequent work of greater accuracy has appeared; a summary of this work has recently been published[4]. In a series of experiments involving the accurate use of a difficult technique, Faurholt[5] measured the actual magnitudes of the rate constants for the reactions of carbon dioxide with water and hydroxide ion. The reaction with hydroxide ion is much the more rapid. The velocity of hydration in a given aqueous solution is thus a function of the *p*H, and can be calculated by summing the contributions to the rate by water molecules and hydroxide ions. In addition, the reaction is catalysed by bases and will be accelerated by anions of weak acids[6].

From these data the velocity of "changes occurring between the collision of carbon dioxide molecules in the air with droplets of the aerosol and the appearance of the corresponding hydrogen ion" can be easily estimated. It is noted[2] that the aerosols are decreasingly effective in acid, neutral, and alkaline solution. In alkaline solution carbonic acid would be produced from carbon dioxide more quickly than in acid or neutral solution; liberation of HOCl would occur more rapidly and loss of HOCl by evaporation would be more serious.

P. V. YOULE.

Research Laboratories,
Imperial Chemical Industries
(Dyestuffs), Ltd.,
Manchester.
Dec. 14.

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RESEARCH ITEMS

Fiction and Fact in Cultural Diffusion

WHEN, some years ago, battle was joined over the question of the diffusion of culture, it was categorically affirmed by members of the diffusionist school in anthropology that no element of culture, such as, for example, the wheel, was ever invented twice, but wherever it occurred it was a product of diffusion from a single centre of origin. Notwithstanding the obvious exaggeration of the statement in this extreme form, instances to the contrary susceptible of absolute demonstrable proof have not been found to be common. This has been especially true in one province, namely, the folk-tale. Here the argument for independent invention has to contend with a weight of evidence in the widespread occurrence of identities in character of motif and details of incident which, occurring time after time in a constant sequence, seem to preclude the probability of anything but a common origin. A familiar example is a folk-tale which occurs in a large number of variants distributed from India to Wales. Its motif is the faithful dog or other animal which is slain by its master on the evidence of bloodstains under the misapprehension that it has killed the child which it was its duty to protect. It occurs in the *Pañcatantra* as the story of the Brahman and the mongoose, and is widely current in India. In 1937 it was recorded among the Kotas of the Nilgiri Hills by Dr. D. G. Mandelbaum in the course of ethnological field-work, and has been studied for its bearing upon the diffusion problem by M. B. Emeneau with his collaboration (*Proc. Amer. Phil. Soc.*, **83**; 1940). The story as told among the Kotas deals not with ancient times, as is usual in their folk-tales, but professes to describe an event which actually took place "about eighteen years ago", the actors in the drama being named, and three of them, including the woman who killed the mongoose, and her son, the infant whom the mongoose saved, being still alive. Investigation in the tribe, and interviews with the persons involved, established the conviction that the event really happened and the story is not here an instance of a borrowed motif. It is suggested by the investigator that, failing acceptance of this conclusion, two alternatives are open—either that the record of an actual event was remade in the classical form, of which, however, the persons concerned and narrators deny any knowledge, or that subconscious knowledge of the classical story forced the woman to act as she did. This latter explanation would, the author points out, involve a peculiarly subtle form of diffusion.

Flint Flakes of the Crag Sea Floor

TRAPS and difficulties of interpretation in geology and prehistory are reviewed by S. Hazzledine Warren in his recent presidential address to the Essex Field Club (*Essex Naturalist*, **27**; 1940). Among these he discusses the Crag sea floor and its flaked flints—"the most important and the most controversial problem of prehistory". The discovery of the remains of the lower jaw of *Elephas meridionalis* at Runton a few years ago suggests by its associations—it lay in the middle of the sands of the Weybourne Crag under the rolled pebble bed at the base of the forest bed with fossil marine shells over, around and under it—that in the presence of a scouring current where sedimentation was arrested, such bones, when the carcass had drifted out to sea, would become broken up and accumulate as a rolled bone bed on the sea floor. Further, phosphatization is a sub-marine product, while the suggestion is in harmony with the rise in the Crag sea floor which brings the Crag sea level to above 300 ft. O.D. The associations of the Suffolk bone bed fall naturally into this epoch of submergence. At all the varying depths of the Crag Sea there is no visible break in marine continuity from the bone bed and stone bed to the overlying sediments. The most remarkable phenomenon of this ancient sea floor is the vast quantity of flaking that is distributed over it. Is the origin of this flaking Eolithic or natural? It has been argued (Prehist. Congress "Handbook"; 1932) that the Crag implements are contemporary with the basement bone bed and are not 'derived'. Drifting, however, must not be excluded nor can the inference that the bone bed was occupied by Tertiary man be accepted, unless he was of the mermaid race. In regard to the artificial origin of certain crude flakes, doubt arises from the observation of the effect of the passage of cart-wheels over flint on a new road. Exact reproduction of the forms claimed as eoliths are produced thereby. Further, eoliths are associated in geological deposits with striations that indicate that very movement under pressure that is required to produce flaking. During the last few years a swing of the pendulum has set in, and the realities of flaking by pressure are beginning to be better appreciated. The ultimate test lies in first-hand observation of the concrete material.

Isotope Exchange in Organic Compounds

Deuterium has been used as an indicator in the study of three-carbon tautomeric systems in which one isomeride is produced in large predominance. A study of an equilibrium state which is more balanced is provided by the system composed of Δ-pentenoic acid $CH_3.CH_2{\cdot}CH{:}CH.CO_2H$, Δ^{β}-pentenoic acid $CH_3.CH{:}CH.CH_2CO_2H$, and β-hydroxyvaleric acid $CH_3.CH_2CH(OH).CH_2.CO_2H$ by D. J. G. Ives and R. H. Kerlogue (*J. Chem. Soc.*, 1362; 1940), which are involved in a 'triangular' system, each member being in direct equilibrium with the other two in an alkali-catalysed isomerization in water. This isomerization proceeds mostly by direct prototropic change but to a less extent by addition and subtraction of water, with the formation of the β-hydroxyacid as an intermediate. The deuterium exchange reaction was studied in a solvent containing deuterium oxide, and the results, although not investigated in detail, are in general conformity with the above reaction mechanism and indicate that a bimolecular mechanism is concerned in the prototropic isomerization.

A Theory of the Structure and Formation of Antibodies

A PAPER by L. Pauling (*J. Amer. Chem. Soc.*, **62**, 2643; 1940) develops a theory of the structure and process of formation of antibodies and the nature of serological reactions which takes account of the present knowledge of the structure and properties of simple molecules as well as most of the direct empirical

information about antibodies. An attempt is made to develop the simplest structure for a molecule with the properties observed for antibodies and the simplest reasonable process for its formation. It is assumed that antibodies differ from normal serum globulin only in the way in which the two end parts of the polypeptide chain are coiled. These parts have many possible configurations and under the influence of an antigen molecule assume configurations complementary to surface regions of the antigen, thus forming two active ends. After the freeing of one end and the liberation of the central part of the chain, this part of the chain folds up to form the central part of the antibody molecule, with two oppositely directed ends able to attach themselves to two antigen molecules. These processes are made clear in the paper by several diagrams. It is shown in detail that most of the reported experimental results are compatible with the theory.

Properties of Liquids in Small Capillaries

SOME experiments by J. L. Shereshefsky (*J. Amer. Chem. Soc.*, **50**, 2715; 1928) showed that the observed lowering of vapour pressure of a liquid in capillaries of 2 to 6 microns in radius was considerably larger than that calculated by Kelvin's equation. This was attributed to an increase in surface tension in the small capillaries. In quartz tubes of radius 5 μ or greater, normal values were found with water, but abnormal values in tubes of 2·07 μ in radius. L. H. Cohan and G. E. Meyer (*J. Amer. Chem. Soc.*, **62**, 2715; 1940) have now made further experiments to find if the surface tension changes in small capillaries. Water and toluene were measured in pyrex glass capillaries of radii as small as 2 μ. The rises were large, in some cases more than 250 cm. The results indicated that the surface tensions and densities of the two liquids do not vary from their normal values within the limit of accuracy of the experiments, $\pm$ 5 per cent. The increase in surface tension thus cannot be accepted as an explanation of the abnormal vapour pressure lowerings found by Shereshefsky.

Quenching of the Resonance Radiation of Sodium

R. G. W. Norrish and W. MacF. Smith have reported the results of an experimental study designed to elucidate the behaviour of different molecules in quenching the resonance radiation of sodium (*Proc. Roy. Soc.*, A, 176, 295; Nov. 1940). By using different homologous series, an attempt has been made to assess the specific qualities of molecular structure which can give rise to quenching. Quantitative indications were got from the strongly quenching gases, the saturated hydrocarbons and the inert gases, but only semi-quantitative indications from the weakly quenching gases, the unsaturated hydrocarbons and the amines. The difference in behaviour of the two groups of gases is too pronounced to be explained in terms of the discrepancy between the amount of energy the sodium atom gives up and the quenching molecule can receive. Unsaturation in the molecule seems to be the deciding factor. Within any one series the number of atoms in the molecule apart from the unsaturated centre appears to have little influence on the quenching ability, which may be regarded as proceeding from a centre of unsaturation. From a qualitative discussion of the results in the light of the Stearn and Eyring theory of non-adiabatic reactions, it is concluded that, in the terminology of the theory of the intermediate complex, the presence of unsaturation manifests itself in a relatively large transmission coefficient.

Periodicity in the Corona

K. G. MELDAHL has published a small work of 14 pages entitled "Tidal Forces in the Sun's Corona Due to Planets Compared with Wolf's Sunspot Curves" (Copenhagen: Berlingske Forlag) which is a continuation of his general investigation of the tidal forces in the corona (see NATURE, **144**, 726; Oct. 28, 1939). The author starts with a disturbance at 15° latitude as the basis, the daily rotation at this position being 14·48°, and deals with the relative and absolute tidal force periods, and finally with the inverse of their products: this is the velocity of rotation which is utilized for combining the periods and attaining the final results. These periods, combined in various ways, denote the time elapsed between repetitions of the mutual positions of bodies without regard to orientation in space. Looking for the possible results of combining numerical data, four solutions satisfy the condition that the result shall be negative, and of these it is found that a period of 11·279 years is derived from V+E+J−(M+S), these letters referring in order to Venus, Earth, Jupiter, Mercury, and Saturn. As explained in the previous review, Mars is neglected, as its tidal force is only about 3 per cent that of the earth. The half-periods of the planets were naturally used, in accordance with the tidal law, and the result is the Wolf's Zurich curves of sunspot periods, as shown in a figure. Meldahl considers that this affords additional proof of the correctness of the tidal force effect. The latitude 15° was selected because data for this region were available, but if latitude 13° is chosen a period of 11·125 years would result. It is claimed that a 9·548 years period obtained from V+E+S−(M+J) furnishes another proof of the tidal forces by apparently causing a beat in the curve in 1837 and a minimum region about 62 years later.

Star-Streaming and Spectral Type

W. M. Smart and T. R. Tannahill made an analysis (*Mon. Not. Roy. Astro. Soc.*, **100**, 1; November 1939), on the two-streams hypothesis, of the proper motions of stars of all spectral types in the Cape Astrographic Zone, the limit of magnitude being 9·0 on the C.P.D. scale. They now give a similar analysis for the spectral subdivisions *A5–F5*, *F8–G5*, *K0–M*, and also for the 11,448 stars in the spectral range *A5–M* (*Mon. Not. Roy. Astro. Soc.*, **100**, 8–9; June 1940). The results for the drift constants, the vertex of the star-streaming and the solar motion are given in tables for the various spectral groups, and it is interesting to notice that the stars in each spectral group are divided fairly equally between Drift i and Drift ii. In spectral groups *F8–G5*, the ratio of the number of stars in the two drifts is 1·038, and the close equality prevails also in the numbers (Table 3) dealing with the vertex of star-streaming and solar motion. This table shows that the longitude of the vertex is, on the average, about 15° higher than that of the galactic centre. The ellipsoidal constants have been derived by the method previously described by Smart, and are in good agreement with the values derived by Jackson from the same data but by a different method. The ratio of the axes of the velocity ellipsoid for the *A5–M* stars is 0·64, and this agrees well with Jackson's value, 0·60.

UTILIZATION OF ELECTRICITY IN AGRICULTURE AND HORTICULTURE

IN the report referred to below*, which was prepared originally for the guidance of the Electrical Research Association, Mr. C. A. Cameron Brown gives a very complete review of the experimental and research side of rural electrification. It is estimated that out of about a quarter of a million farms in Great Britain which are already, or are likely soon to be, within reasonable reach of an electric supply, only about one in eight has yet been connected. The main difficulty in the way of further development is the relatively high cost of providing a supply to the average farm. Most electrical development is based on the expectation that a new customer will bring in an annual revenue equal to about 20 per cent of the capital cost of connecting him to the system. Under present conditions, however, the average annual revenue from a newly-connected farm is unlikely to exceed £25; while the cost of connexion will almost certainly be considerably more than five times this amount. There are two possible lines along which a solution of this difficulty might be sought: to lower costs of connexion by simplification, standardization or other means; or to increase potential revenue by encouraging the wider application of electrical power on the farm; and it is to consideration of the second of these that the report is mainly directed.

Of the various fields of activity in which farmers use power, tillage is by far the largest and most important; but, from the point of view of electrical development, is one of the least hopeful. Battery-driven tractors are out of the question, while electrically operated winding sets, working on the same principle as steam ploughing engines, are too restricted in operation for the present-day farmer. The only real possibility lies in the electrically driven tractor fed from a stationary supply point, through a flexible cable which is paid out and picked up automatically as the machine manœuvres. The main technical problem is the design of a cable-winding mechanism which will give the tractor sufficient flexibility of movement; and it seems unlikely that electrically operated outfits will ever be able to undertake much field work beyond ploughing and the heavier cultivations. Their development would therefore seem to be quite out of tune with the present overwhelming tendency towards all-purpose tractors which can also be used for the after-cultivations of growing crops, and in haymaking, harvesting, transport and so on. Some practical progress in electrical tillage has, however, been made in New Zealand.

In the barnyard, where power may be needed for water supply, grinding and a whole range of food preparing operations, as well as for such subsidiary work as wood-sawing, the position is much more hopeful. In nearly all such operations, electrical power has the advantage of greater convenience; and although few directly comparable costs are available, there is good reason to believe that electric motors will give lower overall running costs than stationary internal combustion engines, provided that electrical power is available at rather less than 2*d*. per kilowatt hour. There is, however, room for developmental research: both into the kind of lay-out which will derive the greatest benefit from electrical working, and into the load factor of barn machinery. At present the typical barnyard engine is a fairly large one of, say, 10–15 h.p., which is regularly called upon to develop full power but which nevertheless will probably not do more than 500 hours of work in a year. As the report points out, running conditions as irregular as these are fundamentally wrong whatever the form of power used, and would be quite unacceptable to the supply engineer who might have to deal with some hundreds of similar cases in his distribution area. The remedy is, of course, the use of lower powered units which run for longer periods, but these will lead to uneconomical labour charges if they are not made practically automatic in operation, while to make them so will involve a considerable measure of barnyard reorganization. The Association's research programme includes some experimental work on these lines, and in the particular case of the grinding mill—the worst offender from the power factor point of view—useful progress has already been made.

In some of the more specialized branches of agriculture, electricity has more to offer than the mere replacement of one form of power by another. In dairying it has overwhelming advantages on grounds of cleanliness alone; while in poultry husbandry it has already been largely responsible for a great increase in chick production. At one time electrical incubation and rearing were regarded as being suitable only for raising 'soft' chicks for the table. Now, however, it is being realized that the same methods are even more suitable for the rearing of hardy stock. It has been found in practice that the dangers of loss from temporary failure of supply are not so serious as was once thought possible, and with the development in the future of storage brooder heating units these dangers will be reduced still further.

In horticulture, less progress has been made because the industry depends mainly on sources of low-grade heat with which, at any rate in the larger-scale commercial applications, it is difficult for electricity to compete economically. In small-scale work and in the amateur greenhouse, on the other hand, sheer economy of working is not always the ruling consideration. In horticulture generally, however, there is plenty of scope for research and experiment; on the use of heating cables for hotbeds, on soil sterilization, and on the use of light for irradiating growing plants.

The last of these is only one of a number of very interesting future possibilities which are dealt with separately in the concluding section of the report. Among others that may be mentioned are crop drying, grain sprouting, electro-culture and ultra-violet irradiation. At the moment their interest may be academic rather than practical; yet they may very well change the face of agriculture in the not too distant future.

* A Critical Study of the Application of Electricity to Agriculture and Horticulture. By C. A. Cameron Brown. (Technical Report Ref. W/T2.) Pp. 84. (London: British Electrical and Allied Industries Research Association, 1940.) 2*s*.

The report as a whole deals with the situation as it existed at the outbreak of war; and it cannot be expected that much further progress will be made within the next year or two. At the same time, as is pointed out in an introductory footnote, the War has brought many of the potential advantages of electricity into even sharper relief. From a shortage of cod liver oil comes a new interest in ultra-violet irradiation; the more frequent use of female labour makes ease of control an important consideration; scarcity of imported feeding stuffs encourages a return to the earlier practice of grinding and preparing foodstuffs on the farm; and so on. But, in his final summary, the author of the report takes the longer view and looks forward to the time, twenty-five or forty years hence, when on all but a small proportion of unreachable farms electricity is used as a matter of course, for all stationary power and for all heating operations. This state of affairs is very likely to come about—not, perhaps, as the direct result of technical or agricultural research, but as a matter of sociological progress. The future of agriculture in Great Britain is bound to depend a great deal on giving the rural dweller his due share of urban amenities, and in America it is recognized already that the seller of electric kettles, cookers and washing machines plays a great part in the spread of farm electrification.

FORESTRY IN AFRICA

It is interesting to note in recent annual forestry reports how what may be termed a correct and long-sighted forest policy is gradually becoming recognized by the civil administration as a matter which can no longer be left to chance. This has recently been exemplified in NATURE. In the Gold Coast annual report (1938–39, Govt. Printer, Accra, 1939) the Conservator, in discussing the history of the forests, says that though some thirty-one years ago the indirect value of the maintenance of a proportion of tropical lands under forest was clearly stressed, yet the progress of reserving forests for the use of future generations, the maintenance of soil fertility, and so forth, has not proved an easy task. Forests, of necessity, occupy land, he says; and difficulties are increased when all the land, although surplus to immediate wants, is owned by a community with an unawakened national sense; to the individuals the cash resulting from an immediate sale is much to be preferred to the somewhat abstruse prospects from reservation in favour of future generations or a possible improvement in their water supplies. The failure to press for a more rapid selection of forests for reserves when surplus land was plentiful has resulted in an increasing opposition which education and propaganda are only gradually lessening; while the remaining forests of the Colony can no longer be regarded as excessive if the happiness and health of the community are to be assured.

In the Nigerian forestry report for 1939 (Govt. Printer, Lagos, 1940) the Conservator re-defines the aims of forestry in that part of West Africa on the well-known lines which have been so often in the past disregarded by the Governments. He sounds a wise note, too often neglected, that the productive motive, though secondary (it has usually been placed first), is an important one. "If," he says, "forest, shelterbelts and shade trees have to be maintained for protection, it is clear that the fullest possible use should be made of them, and this can best be effected by fostering African industries using forest produce as raw material." These industries, as was foreseen several years ago by senior French district administrative officers in the Ivory Coast, will in the future be more important in the economy of the country than any export trade in timber overseas. It is a step in advance that the head of a West African Forest Department should at length express this important view. The Conservator remarks that the Department is becoming continually more involved, with other rural departments, in the study of the wider problems of land use and land planning. But here again new forest reservation, so urgently needed, proceeds slowly in the south owing to political and legal difficulties and problems of land tenure; and this in spite of the fact that all the forms of deterioration—of soil, climate and water supply—are in active progress in various parts of the southern provinces. There can be little hope of more than local remedy until the chaotic situation as regards land tenure is resolutely tackled.

The annual forestry report for Kenya for 1939 (Govt. Printer, Nairobi, 1940) strikes rather a different note. The outbreak of war has caused some reduction of the staff (junior officers allowed to join or called up to join the Army, which has been the case in both Nigeria and the Gold Coast), but has considerably increased the demand for forest produce. This latter and the increased revenue thereby realized might have proved of some satisfaction to the Department—especially the revival in the old export trade of boritis (mangrove) poles—were it not for the former factor. The demand for produce from the forests was increased during the latter part of the year by War Department demands. At all sawmills trade was fairly brisk, and several millers increased their output considerably by improved organization and efficiency. Unfortunately the urgent military demand for building timber has meant that air-seasoning has not been possible prior to the delivery of the timber.

Regrettable as this may seem, equally unfortunate is the fact that most of the timber requisitioned by the military authorities in war-time is utilized for purposes often ephemeral and in any event has a comparatively short life. A far more important point is the factor that, with a reduced staff, who is to undertake the necessary supervision over the extra fellings which are to take place? The limit to further indiscriminate fellings and resultant ultimate disappearance of the African forests has been reached, or is perilously close. If war fellings are to take place unchecked in forests the volume content of which is but imperfectly known, neither administration nor the local forest department is fulfilling its true functions to the native communities.

THE BRITISH PHARMACOPŒIA IN WAR-TIME

THE text is available of a further addendum to the British Pharmacopœia. Published under the direction of the General Medical Council, it became effective on January 1. Of main interest is the inclusion of monographs on a number of synthetic substances, formerly of foreign manufacture, and first introduced to the medical profession under proprietary names, which are now produced in Great Britain, in some cases under licences granted by the Comptroller-General of Patents.

The probability that certain 'new remedies' of this type would be introduced into the British Pharmacopœia in due course has already been mentioned in NATURE (August 31, p. 309). In selecting eleven of the more important of these products for official recognition the authority has adopted new names for their pharmacopœial titles. The substances under their official designations are as follows, the names in brackets being those under which they were first known: bromethol (avertin), carbachol (doryl), hexobarbitone and soluble hexobarbitone (evipan sodium), iodoxyl (uroselectan-B), leptazol (cardiazol), mepacrine hydrochloride (atebrin), mepacrine methanesulphonate (atebrin musonate), nikethamide (coramine), phemitone (prominal), and stibophen (fouadin).

The purpose of laying down standards for these products is to ensure that important synthetic remedies previously obtained from abroad will continue to be available in medical practice; the substances can be so adequately tested for identity and purity by chemical means that no question of the equivalence of the British preparations can arise.

Other monographs which have been added are on aneurine hydrochloride, chlorocresol, and paste of tannic acid. The inclusion of aneurine hydrochloride is of general interest since it is the vitamin—B_1—which it is proposed to add to white bread to replace the loss resulting from milling. Aneurine, which is also known as thiamine, plays an important part in carbohydrate metabolism. Chlorocresol (*para*chloro-*meta*cresol) has been added because of its use as a bactericide in sterilizing solutions for injection and as a bacteriostatic preservative in certain solutions; it is one of the ingredients of the newly introduced paste of tannic acid.

Monographs which are amended are those on atropine sulphate, injection of bismuth salicylate, hard soap and soft soap. The only change in the case of atropine sulphate is in the official statement of the melting point; for lead plaster arachis oil may be used in place of olive oil, and the alterations in the monographs on the soaps are made with the object of enlarging the choice of vegetable oils and authorizing the use of soda instead of potash in the process of saponification.

The addendum also embodies monographs which had already been amended by notices in the *Gazette*, the items concerned being lead plaster, injection of mercury, injection of mercurous chloride, strong ointment of mercury and ipecacuanha. Amendments which have been made in the appendixes, which relate to tests, are naturally the result of the additions to the British Pharmacopœia and the alterations which have been effected by the new addendum.

FORTHCOMING EVENTS

Monday, January 13

ROYAL COLLEGE OF SURGEONS OF ENGLAND (at the Royal Society of Medicine, 1 Wimpole Street, London, W.1), at 3 p.m.—Prof. H. A. Harris: "Growth in General".

ROYAL GEOGRAPHICAL SOCIETY (at Kensington Gore, London, S.W.7), at 3 p.m.—Prof. O. T. Jones, F.R.S., and Mr. W. V. Lewis: "Water Levels in the Thetford Meres".

Tuesday, January 14

ILLUMINATING ENGINEERING SOCIETY (at 32 Victoria Street, London, S.W.1), at 2.30 p.m.—Dr. W. D. Wright: "The Fundamental Principles of Vision in Very Weak Light".

ROYAL COLLEGE OF SURGEONS OF ENGLAND (at the Royal Society of Medicine, 1 Wimpole Street, London, W.1), at 3 p.m.—Prof. H. A. Harris: "The Anatomy and Physiology of Locomotion and Posture".

Wednesday, January 15

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Miss Caroline Haslett: "Women in Industry".

ROYAL COLLEGE OF SURGEONS OF ENGLAND (at the Royal Society of Medicine, 1 Wimpole Street, London, W.1), at 3 p.m.—Prof. H. A. Harris: "The Inherent Weaknesses of the Human Body with reference to Orthopædic Practice".

Thursday, January 16

ROYAL SOCIETY OF MEDICINE (at 1 Wimpole Street, London, W.1), at 2.15 p.m.—Prof. P. A. Buxton: "Some Recent Work on the Louse".

PHARMACEUTICAL SOCIETY (at 17 Bloomsbury Square, London, W.C.1), at 2.30 p.m.—Mr. Arthur Mortimer: "Drug Supplies in War Time".

Friday, January 17

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (in the Mining Institute, Newcastle-upon-Tyne), at 6 p.m.—Mr. G. E. Manville: "Optical Instruments: particularly Large Astronomical Telescopes".

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

ASSISTANT ENGINEER FOR THE MALAYAN PUBLIC WORKS SERVICE—The Crown Agents for the Colonies, 4 Millbank, London, S.W.1 (quoting M/9306).

HEAD OF DEPARTMENT OF TRAINING COLLEGE AND SCHOOL OF DOMESTIC SCIENCE of the Witwatersrand Technical College, Johannesburg—Frank Ross and Co., 9 Fenchurch Avenue, London, E.C.3.

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

University of Cambridge. Twenty-eighth Annual Report of the Director of the Solar Physics Observatory. Pp. 2. (Cambridge: Solar Physics Observatory.) [1312

Bibliography of Spectrochemical Analysis. Compiled by D. M. Smith. Second edition. Pp. 56. (London: British Non-Ferrous Metals Research Association.) 3s. [1912

Scientific Proceedings of the Royal Dublin Society. Vol. 22 (N.S.). No. 33: The Chlorination of Derivatives of o-Orsellenic Acid. By Dr. T. J. Nolan and D. Murphy. Pp. 315–320. 6d. Vol. 2 (N.S.), No. 34: Studies in Peat, Part 9: The Cerotic and Carboceric Acid Fractions of Mona Wax. By Prof. J. Reilly and John P. Wilson. Pp. 321–326. 6d. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) [1912